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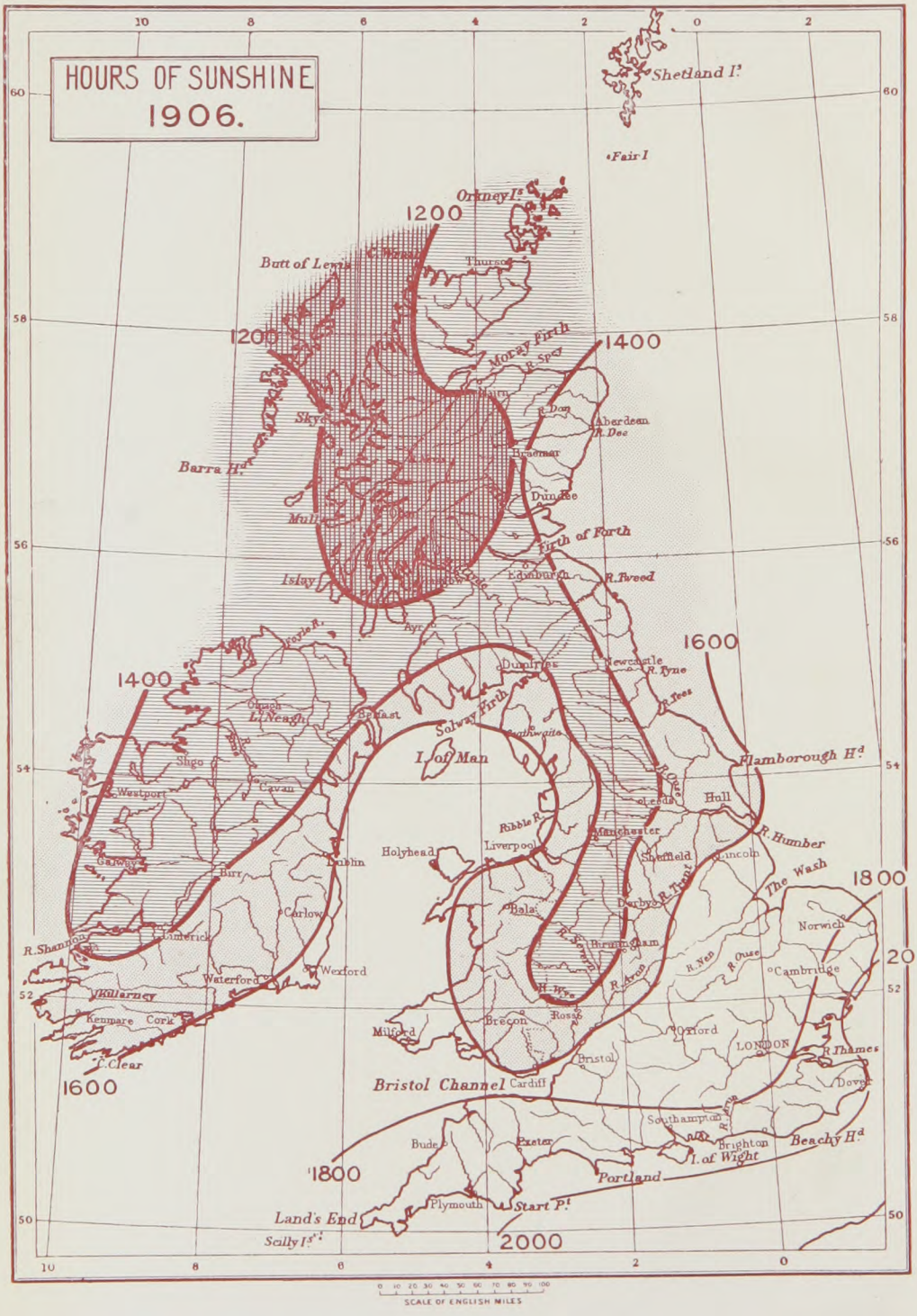
By R. H. CURTIS.



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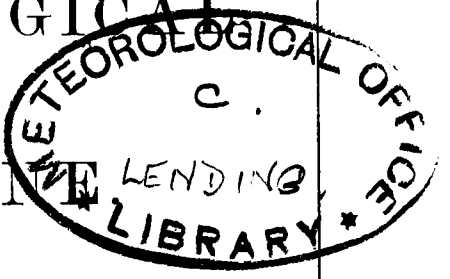

Edited by HUGH ROBERT MILL, D.Sc., LL.D.

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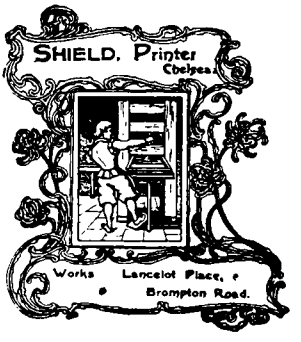
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INDEX.

PAGE

Abbe, Prof. Cleveland, The Relation between Climates and Crops (review) 172
Amir of Afghanistan on Rain 239
Anemometer for Kites, Recording, by W. H. Dines, F.R.S. 24
April, 1906, Rainfall of, 61; Weather of, 64; In New South Wales 109
Astronomical Observations, Influence of Temperature on... .. 45
Atlantic Ice, Cold Weather and... 108
Atlas of India, Climatological (review) 181
Atmosphere, Dr. W. N. Shaw on Circulation of the... 54, 70, 85, 106
August 2nd, 1906, Thunderstorm of..... 126, 133, 150, 228
Aurora borealis 214
Backhouse, T. W., Continuous Rainfall, 92; Heavy Rainfalls 192
Bacon, T. W., A Contrast in Summer Rain 170
Baden-Powell, Major B. F. S., The Science Year Book (review)... 237
Baxendell, J., Fernley Observatory, Southport; Report for 1905 (review)..... 174
Beaufort Scale of Wind Force, The 146
Bedford, H., Unusual Sky Colours 51
Beira, Rainfall of 193
Bentley, R., On Meteorology in Daily Life, 12; Thunderstorm of May 8th, 65; Unbroken Run of Days with Sunshine 169
Bigelow, F. Hagar, The Diurnal Periods in the Lower Strata of the Atmosphere (review) 194
Biggs, J. H. W., Nature's Reveillée 233
Bland, F. H., The Great Heat ... 170
Bonacina, L. C. W., Localization of Snow, 28, 48; On the Mode of Formation of Rain, 10; Storm at Weybridge on July 12th, 132; Storm Clouds on November 3rd, 192; Thunderstorms of August 2nd, 133; Treacherous Character of the English Spring..... 87

PAGE

Boys, Rev. H. A., Colour of Lightning, 108; The Summer Rainfall of 1906..... 211
Bracke, A., Representation of Atmospheric Conditions (review) 15
British Association, Meteorology at the.....121, 141, 144
British Rainfall, 1905 145
Brodie, F. J., on Thunderstorms during 1881–1905..... 111
Brook, C. L., Audible Meteors ... 231
Buchan, A., LL.D., F.R.S. and R. T. Omond, The Meteorology of Ben Nevis (review)..... 35
Buchan, The late Miss J. H 45
Butler, W. B., The Great Heat ... 155
Cambridge and Huntingdonshire Rainfall Table 55
Campbell-Stokes' Sunshine Recorder, An Instrument for Adjusting 89
Canada, Rain-making in 115
Carter, W. J., High Temperatures in March, 1906, 30; Thunderstorm of August 2nd 130
Cave, C. J. P., Thunderstorm of August 2nd 131
Chambers, C. P., Snow on Hill Sides 65
Cheshire, Heavy Rainfall in 63
Chile Earthquake, Atmospheric Phenomena during the, by W. Gaw 226
Christy, W. M,, Thunderstorm of August 2nd 131
Clayden, A. W., Cloud Studies (review) 51
Clayton, H. H. 115
Climatological Tables for the British Empire 20, 40, 60, 80, 100, 120, 140, 160, 180, 200, 220, 244
Cordeiro, F. J. B., Gyroscopes and Cyclones (review) 175
Courtenay, Major G. H., The Green Flash 11, 91
Curtis, J. A..... 54
Curtis, R. H., A Plea for the teaching of Meteorology, 184; Bright Sunshine in 1906 221
Cyclonic Distribution of Rainfall, The..... 31, 67

PAGE

De Bort, Teisserenc, on the Meteorology of the Free Atmosphere 113
Dechevrens, Rev. Marc, S.J., The Hydrothermodynamic Theory of Atmospheric Whirls (review) 15, 27
Dines, W. H., F.R.S., Recording Anemometer for Kites, 24; Two New Light Meteorographs, 101; Typical Squall at Oxshott 112
Douglas, W. A. S., Fall of a Wireless Telegraphy Tower 201
Drought in London, 62; in the South of England 149, 169
Durand-Greville, E., on The Law of Squalls and Thunderstorms 82
Earthquake Shock in South Wales 115
— Atmospheric Phenomena during the Chile, by W. Gaw 226
Eiffel, G. (reviews of works by) ... 111
Electrical Resistance Thermometers 171
Eliot, Sir John, K.C.I.E., F.R.S. Climatological Atlas of India (review) 181
Ewart, Miss M. A., Thunderstorm of August 2nd 131
February and March, Cold in..... 50, 90
February 8th, 1906, Thunderstorm of..... 6, 90, 112
Fireballs, Meteors and..... 191, 212
Fox, W. L., The Green Flash..... 234
Frankenfield, H. C., Floods of the Spring of 1903 in the Mississippi (review) 15
Fritzsche, R., Precipitation, Run-off and Evaporation (review) 175
Gaw, W., Atmospheric Phenomena during the Chile Earthquake 226
Godden, W., Thunderstorm of August 2nd 150
Godwin-Austin, Col. H. H., Thunderstorm of August 2nd 128
Gold, E..... 54
Green Flash in Fiction, The..... 68
Green Flash on the Horizon, The 11, 21, 29, 41, 67, 68, 91, 150, 189, 209, 234
Hall, W., Thunderstorm of February 8th, 1906..... 8
Halm, Dr. J., on The Influence of Temperature on Astronomical Observations..... 45
Hands, A., on So-called Vagaries of Lightning, 72; Lightning Research Committee, 93; On Lightning Conductors 230

PAGE

Hann, Dr. Julius, Handbook of Meteorology (review) 35
Harding, J. S. 54
Hawke, E. L., Thunderstorm of May 8th..... 65
Heat, The Great..... 153, 170
Hebron, Climate of..... 135
Hedges, K., Modern Lightning Conductors (review).. 75
Hellmann, Prof. Dr. G., Precipitation in the North German River Basins (review) 110
Hepworth, Capt. Campbell, Cold Weather and Atlantic Ice..... 108
Hildebrandsson, Prof. H. H. 239
Hong-Kong, Typhoon at 171
Hooker, C. P., Rainfall Terminology..... 192
Hopkinson, J., Rainfall of January, 1906, 5; Thunderstorm of February 8th, 1906..... 8
Horner, D. W., April Weather, 64; Drought in the South of England..... 149
Hunt, H. M., April, 1906, in New South Wales 109
Huntley, E., An Audible Meteor... 190
Hydrothermodynamic Theory ... 15, 27
Hygrometer, Lambrecht's Polymeter and 151
India, Climatological Atlas of..... 181
Instruments, The Packing of ... 9, 94
Jordan, J. B., Photographic Sunshine Recorders 168
July 12th, Storm at Weybridge on 132
June, 1906, Rainfall of 105
June 28—29, 1906, Rainfall of..... 102
Kite Committee, Report of the ... 144
Kites, Recording Anemometer for, by W. H. Dines, F.R.S. 24
Knoche, W. The Distribution of Heat (review) 53
Lambrecht's Polymeter and Hygrometer 151
Lander, A., Automatic Record of a Thunderstorm, 95; Photographic Sunshine Recorders... 188
Lectures, Meteorological, 54, 193, 215, 239
Lempfert, R. G. K., 54; Thunderstorm of February 8th ... 7, 90, 112
Lightning, Colour of, 108; so-called Vagaries of 72
— Conductors 230
— Research Committee..... 93
Line-Squalls and Thunderstorms... 82
Lippincott, R. C. C.. The Green Flash..... ..... 11, 29, 92, 190, 234
Local Climatology and Orchard Sites, by A. O. Walker..... 205

PAGE
Lunar Rainbow, Double... 214
Lyle, J., Radiation Phenomena in South Africa..... 166
Lyons, Captain H. G., Rains of the Nile Basin in 1905 (review) 195
MacDowall, A. B., Cold in February and March, 50, 90 ; The Sunspot Question..... 232
Machrihanish, Fall of the Wireless Telegraphy Tower at..... 201, 239
Maclear, Adm. J. P., Thunderstorm of August 2nd 126, 228
March, 1906, Cold in February and 50, 90 ; High Temperatures in 30
Margules, Max, On the Energy of Storms (review) 14
Marriott, W., Lectures by, 193, 215, 239 ; on the Abnormal Weather of the Summer of 1906, 207 ; Popular Meteorological Handbook (review) 238
Mascart, Professor 215
Masson, J., The Thunderstorm of February 8th, 1906 9
Mathison, J., The Great Heat..... 155
Mawley, E., on Phenological Observations for 1905 26
May, 1906, Rainfall of, 81 ; in Scotland..... 135
May 8th, Thunderstorm of..... 65, 94
McKendrick, Prof. J. G., F.R.S., The Green Flash 209
Mellish, H., Some Aspects of Meteorology (review), 54 ; The Great Heat 155
Meteorographs, Two New Light, by W. H. Dines, F.R.S. 101
MeteorologicalBreakfast, 1906, The 121
— Committee, Report of the (review) 164
— Council, Report of the 73
— Discussions, Informal 215
— Exhibit for New Zealand, 115, 134 ; Exhibition 115
— Lectures 54, 193, 215, 239
— News and Notes, 13, 54, 115, 170, 193, 215, 239 ; Notes on the Months, 19, 39, 59, 79, 99, 119, 139, 159, 179, 199, 219, 243
— Society, Royal, 11, 26, 47, 72, 89, 111, 207, 228; Scottish 45, 135
Meteorology, A Plea for the Teaching of, by R. H. Curtis 184
— at the British Association 121, 141, 144
— in Daily Life 12
— Local Societies and 123, 141
— of the Free Atmosphere 113
PAGE
Meteor, An Audible 190, 212, 231
Meteors and Fireballs 191, 212
Mill, Dr. H. R., On Absolute Drought in London. 62 ; On International Polar Congress, 207 ; On Local Societies and Meteorology, 123, 141 ; On "Rain," 171 ; On South Africa 48
Moore, A. R., Lunar Rainbow 214
Nash, W. R., Rainbows..... 214
New South Wales, April, 1906, in 109
Nature's Reveillée 233
Newman, T. P., Rainfall of January, 1906, 5 ; Thunderstorm of May 8th, 94 ; Thunderstorm of August 2nd 129
Northumberland, Heavy Rainfall in 64, 92
November, 1906, Rainfall of 215
November 3rd, Storm Clouds on... 192
October, 1906, Rainfall of..... 187
Omond, R. T., On Temperature of Ben Nevis and Fort William, 46 ; and Dr. Buchan, The Meteorology of Ben Nevis (review) 35
Orchard Sites, Local Climatology and, by A. O. Walker 205
Oxshott, A Typical Squall at 112
Packing of Instruments, The 9, 94
Parson, Mrs., Rainfall of January, 1906..... 6
Paterson, Dr. A., on Climate of Hebron 135
Pearson, E., Heavy Rainfall in Cheshire..... 63
Pemba, Meteorological Observations at 47
Pennant, P. P., That's Why 232
Phenological Observations for 1905 26
Plenderleath, Commander W. C., Rainfall of January, 1906..... 5
Polar Congress, International 170, 207
Polymeter and Hygrometer, Lambrecht's 151
Preston, A. W., Thunderstorm of February 8th, 1906..... 8
Radiation Phenomena in South Africa, by J. Lyle 166
Rain, Mode of Formation of 10
Rainbows 214
Rainfall, Cyclonic Distribution of, 31, 67
— Monthly, 17, 18, 37, 38, 57, 58, 77, 78, 97, 98, 117, 118, 137, 138, 157, 158, 177, 178, 197, 198, 217, 218, 241, 242 ; of South of England in January, 3 ; of April and of the first four

PAGE

months of 1906, 61, 63, 64; of May and of the five months of 1906, 81; of May, 1906, in Scotlond, 135; of June and the first half of 1906, 105; of June 28–29, 1906, 102; of the Summer Half-year, 1906, 161; of the Summer of 1906 in Wessex, 211: of October and of 1906, 187: of November, 1906, 215: of 1906 223
— of Beira, 193; in Cheshire, 63; in Northumberland, 64, 92; at Sunderland 92, 192
— Tables, The, 1; Cambs and Hunts..... 55
— Terminology..... 192
Rainmaking in Canada, 115; and Sunshine 115
Rambaut, Dr. A. A., F.R.S, The Green Flash on the Horizon 21, 41

REVIEWS:—

Travaux de la Station Franco-Scandinave des Sondages aëriens à Hald, 1902-1903 14
Ueber die Energie der Stürme, von Max Margules 14
The State of the Ice in the Arctic Sea, 1904 15
The Floods of the Spring of 1903 in the Mississippi Watershed, by H. C. Frankenfield 15
La representation des situations atmosphériques, par A. Bracke 15
La Théorie hydrothermodynamique des Tourbillons atmosphériques en face du problème des variations de la température de l'air, par R. P. Marc Dechevrens 15
Lehrbuch der Meteorologie von Dr. Julius Hann 35
The Meteorology of the Ben Nevis Observatories. Part III. Ed. by A. Buchan, LL.D., F.R.S., and R. T. Omond..... 35
Cloud Studies, by A. W. Clayden 51
An Introduction to Practical Geography, by A. T Simmons and Hugh Richardson 52
Ueber die raumliche und zeitliche Verteilung des Wärmegehalts der unteren Luftschicht, von Walter Knoche... 53
The Hygiene of the Zones, by R. De C Ward 53
Some Aspects of Meteorology, by H. Mellish 54

PAGE

REVIEWS (*con.*)—
Report of the Meteorological Council for the year ending 31st March, 1905..... 73
Modern Lightning Conductors, by Killingworth Hedges 75
Die Niederschläge in den Norddeutschen Stromgebieten, von Prof. Dr. G. Hellmann 110
Dix Années d'Observations Météorologiques à Sèvres, 1892-1901, par G. Eiffel 111
Etudes pratiques de Météorologie et Observations comparées des Stations de Beaulieu, Sèvres et Vacquey, 1903, par G. Eiffel 111
Types Généraux des Comparaisons Météorologiques appliqués à l'étude des Stations de Beaulieu-sur-Mer, Sèvres et Vacquey, 1905, par G. Eiffel 111
Les Observations Courantes en Météorologie et Comparaison des Stations de Beaulieu, Sèvres et Vacquey, par G. Eiffel 111
A First Report on the Relations between Climates and Crops, by Cleveland Abbe..... 172
Memoirs of the Geological Survey. The Water Supply from Underground Sources of Lincolnshire, Suffolk and the East Riding of Yorkshire 173
Fernley Observatory, Southport. Report and Results of Observations for 1905, by Joseph Baxendell 174
The State of the Ice in the Arctic Seas, 1905 174
National Physical Laboratory. Report of the Observatory Department for 1905 175
Gyroscopes and Cyclones, by F. J. B. Cordeiro..... 175
Niederschlag, Abfluss und Verdunstung auf den Landflachen der Erde, von R. Fritzsche ... 175
Studies on the Diurnal Periods in the Lower Strata of the Atmosphere, by F. Hagar Bigelow 194
The Rains of the Nile Basin in 1905, by Captain H. G. Lyons 195
The Science Year Book. Ed. by Maj. B. F. S. Baden-Powell... 237
The Life-History of Surface Air Currents, A Study of the Sur-

PAGE

REVIEWS (*con.*)—
face Trajectories of Moving Air by W. N. Shaw, Sc.D., F.R.S., and R. G. K. Lempfert 237
Popular Meteorological Handbook. Some Facts about the Weather, by W. Marriott 238
Die meteorologische Äquator im Stillen Ozean, von R. Westermann 238
Richardson, Hugh, and A. T. Simmons, Practical Geography (review) 52
Rogers, H. K. G., Thunderstorm of August 2nd 131
Russell, Spencer C., Aurora borealis, 214; The Great Heat, 154; Thunderstorm of August 2nd 130
Science Year Book, The 13
Searle, G., The Great Heat 154
Selby, B. P., Heavy Rainfall in Northumberland 64, 92
Shaw, Dr. W. N., F.R.S., On Circulation of the Atmosphere, 54, 70, 85, 106; The Life-History of Surface Air Currents (review), 237; and Dr. G. C. Simpson, on An Instrument for Adjusting Campbell-Stokes Sunshine Recorder 89
Simmons, A. T., and H. Richardson, Practical Geography (review) 52
Simpson, Dr. G. C. 171
(*See also* Dr. W. N. Shaw).
Sky Colours, Unusual 51
Smith, G. Michie, The Green Flash 91
Snow, Localization of 28, 48, 65
Snowstorms of 1906, The Christmas 224
South Africa as seen by a Meteorologist 48
— Radiation Phenomena in, by by J. Lyle 166
Spring, Treacherous character of the English, by L. C. W. Bonacina 87
Squall at Oxshott, A Typical 112
Stevens, Miss C. O., on The Value of a Projected Image of the Sun for Meteorological Study 73
Storm Clouds on November 3rd ... 192
Strachey, Sir Richard 12
Summer of 1906, Abnormal Weather of the, 207; Rainfall of the 161, 211

PAGE

Summer Rain, A Contrast in 170
Sunshine in 1906, by R. H. Curtis 221
— Rain-making and 115
— Recorders, Photographic... 168, 188
— Run of Days with 169
Surrey Hills, Snow on the 48
Sunspot Question, The 232
Sutton, J. R., The Packing of Instruments 94
Sydney Climatological Normals... 30
Symons Medal, The 12
Telegraphic delays 55
Temperature of Ben Nevis and Fort William 46
—, Monthly, 16, 36, 56, 76, 96, 116, 136, 156, 176, 196, 216, 240; in March, 1906 30
Terminology, Rainfall 192
Thunderstorm, Automatic Record of a 95
— of February 8th, 6, 90, 112; of May 8th, 65, 94; of June 1st, 95; of August 2nd 126, 133, 150, 228
Thunderstorms during 1881—1905 111
—, Line Squalls and 82
Thurburn, A., The Green Flash, 150, 210
Typhoon, Severe 171
Udden, J. A., On the Cyclonic Distribution of Rainfall 31, 67
Vagaries of Lightning, So-called.. 72
Waldegrave, Earl, The Drought... 169
Walker, A. O., Local Climatology and Orchard Sites 205
Ward, Prof. R. De C., The Hygiene of the Zones (review) ... 53
Watt, A., on Climate of Hebron, Syria, 135; on Rainfall of May, 1906, in Scotland 135
Weather Forecasts, Long Period... 55
Weather Report, Weekly 13
Westermann, R., The Meteorological Equator in the Pacific Ocean (review) 238
Weybridge, Storm at 132
Whitmell, C. T., The Green Flash 91, 189, 209
Why? 211, 232
Wilson-Barker, Capt. D., The Green Flash 67
Wind-Force, The Beaufort Scale of 146
Wireless Telegraphy Tower, Fall of a, by W. A. S. Douglas 201, 239
Wood, H. E. 54
Wood, J. G., Meteors and Fireballs 212
Woods, J. W., Rainfall of January, 1906 5

LIST OF ILLUSTRATIONS.

Duration of Sunshine in 1906 (map) ..... *Frontispiece.*
Rainfall of January, 1906 (map) ..... Page 4
Registering Arrangement of Kite Anemometer ..... ,, 24
Method of attaching Supplementary Kite ..... ,, 25
Diagram of the Cyclonic Distribution of Rainfall (*Fig.* 1) ..... ,, 32
,, ,, ,, ,, (*Fig.* 2) ..... ,, 33
Diagram explanatory of Green Flash ..... ,, 41
Barogram of Line Squall ..... ,, 84
Isobars showing two Line Squalls ..... ,, 84
Automatic Record of a Thunderstorm ..... ,, 95
The Dines' Light Meteorographs ..... *face* ,, 101
Rainfall of June 28-29, 1906 (map) ..... ,, 103
Photographic Sunshine Records ..... ,, 188
Wireless Telegraphy Tower at Machrihanish ..... ,, 202
Concrete Block with Stays of ditto ..... ,, 203
Foundation of ditto ..... ,, 203
Rainbows ..... ,, 214

Symons's

Meteorological Magazine.

No. 481. FEBRUARY, 1906. Vol. XLI.

OUR FORTY-FIRST VOLUME AND THE RAINFALL TABLES.

With this number our forty-first volume commences, and the occasion seems to be appropriate for a few words to our readers on the objects for which this Magazine was founded and the means by which we endeavour to carry these aims into effect. Originally a two-page "Rain Circular," intended to keep the keener rainfall observers in touch with each other's work from month to month, it became an 8-page magazine in 1866, including one page of rainfall tables and four pages of remarks by observers on the weather of the month. Correspondence dealing with matters of immediate interest to meteorological observers soon came to occupy an important place, and the review of meteorological books, both English and foreign, was made a leading feature. The proceedings of meteorological societies in this country were always recorded punctually. Extreme conciseness was necessary on account of the modest size of the little Magazine, and as the monthly numbers grew to two and a half times their original size (though the price stood still at the original figure), the additional space was devoted to more numerous reviews, more frequent illustrations, and to occasional articles of a more abstract kind bearing on meteorological theories. More subjects were dealt with, but if anything the literary matter was more concentrated than before.

We are endeavouring to maintain this Magazine as a repository of recent meteorological news, as a mirror of meteorological thought, so far as meteorological thinkers care to allow their reflections fall upon it, and as an independent medium for the expression of opinion. It is true that to some extent the Magazine is supplementary to the annual volumes of "British Rainfall," and that its relation with rainfall observers is rather more intimate than with students of meteorology in general, but we should not like this fact to affect the conduct of the paper in any way.

Our attitude is one of friendliness to every person and institution engaged in the serious study of the atmosphere, and our ambition is to be helpful to all and to interfere with none. We see with

pleasure that during the last few years meteorology has entered upon a period of rapid advance, in which the observer has a smaller share than the investigator, but we see also on every hand how the work of the investigator has been hampered and harassed by the want of the solid basis of patiently accumulated fact which only a succession of conscientious and persevering observers can bring together. Both types of activity meet in our pages, and sometimes one, sometimes the other, preponderates, but we do not regard them as antagonistic and would view it as a calamity if either were to be discouraged. It is becoming more than ever necessary that while work is encouraged in every department, and the natural aptitudes of those who are enthusiastic taken advantage of to the full, the waste of time and money resulting from the overlapping of agencies working with the same ends in view should be checked and co-operation between them secured. There are difficulties in the way of such a result, but they do not seem to us to be insuperable.

We have referred before to the wonderful instinct, or rather genius, with which the founder and first editor, Mr. G. J. Symons, hit upon methods of presenting meteorological data which required scarcely any modification as the years went on, and it is only after long thought and much delay that we have allowed ourselves to make the slightest change. New readers and old friends often favour us with advice which we are always glad to receive and consider, and though the advice of an individual cannot always be accepted, we believe that the change in the Tables of Temperature and Rainfall which we introduce this month gives effect to a great number of the desiderata which have been put before us during the last five years. New observers constantly want to know the precise position of the stations the records of which are quoted, and in the new combined Table on pp. 16–17 we give not only the name and county but also the latitude and longitude to the nearest minute. A minute of latitude is a trifle more than a mile, a minute of longitude in these latitudes rather more than half a mile, so that on a map of the British Isles on the scale of 20 miles to an inch the position of each station is within an area not much larger than a pin head at the intersection of the parallel and meridian which are designated. The height above sea-level is given also in feet, usually correctly, and probably in no case more than 20 feet in error. The temperature data are given exactly as before, but we are unable to say that the figures are really comparable, because all the thermo meters are not exposed alike nor are all the instruments verified. It is incomprehensible to us how observers will sometimes lavish hours and days of their valuable time in reading scales, entering, adding, averaging and pondering over figures derived from thermometers which only cost perhaps half-a-crown, and were not worth that; yet we know that many people do so. As we do not know in every case that trustworthy thermometers are employed,

we lay less stress upon the first page of this table than on the second.

The second half of the Table, on p. 17, combines the former monthly rainfall table and the aggregate table, which for the last few years has wandered somewhat uneasily through the text. It contains additional information as well. To begin with, we give the average rainfall for the month in question at most stations, calculated in each case to the period of thirty years, 1870—99. A fifty-years' average would be better for monthly amounts, but the data are not available. In the next column the actual rainfall is expressed as a percentage of the average. In other words, the average rainfall for each station is represented as 100 and the actual rainfall is given by a figure bearing the same ratio to 100 as the number of inches measured bears to the average amount. Then follows the actual rainfall for the month as measured up to 9 a.m. on the 1st of the month following, and the difference between the actual and the average rainfall, the positive sign (+) indicating that the rainfall of the month is above the average, the negative sign (—) that it is below the average. The fall on the wettest day in the month, the date of that day, and the number of rain days—*i.e.*, days on which at least ·01 in. of rain was recorded—complete the statistics for the month.

The next four columns, blank on this occasion as they would merely be a repetition of the foregoing, will give the total rainfall from January 1st to the end of the month dealt with. Then in bold type comes the mean annual rainfall calculated to the average of 30 years, and the line is closed by the repetition in a somewhat abbreviated form of the name of the station, for the bookbinder is not always successful in folding the sheets so that the two pages shown at an opening correspond line for line.

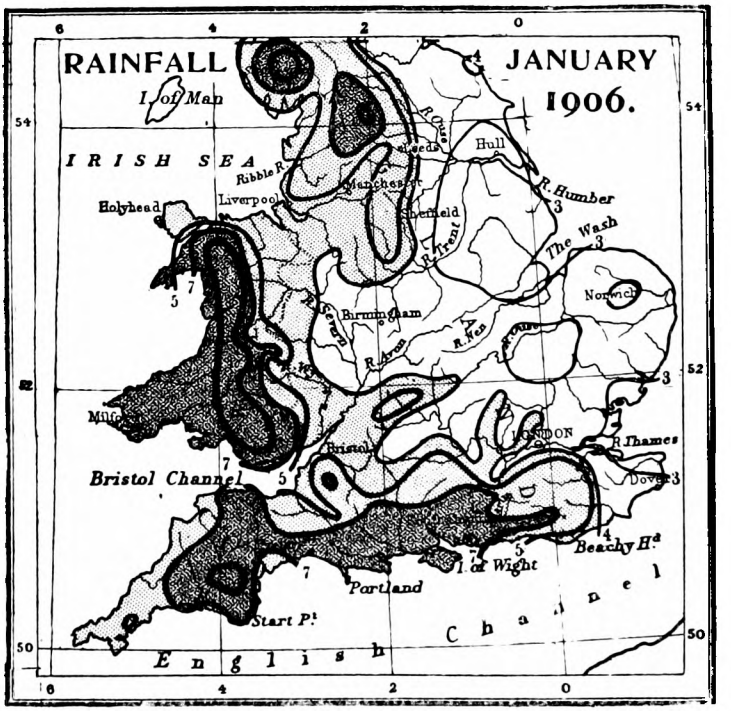
The new Table involves a greater expenditure of time than the old form, and we urge our readers whose records appear in it to send in their returns as early as possible, and at the latest by the 8th of the month. The compilers do not grudge their work, believing that the Table as now presented is both more interesting and more useful than it was before.

THE RAINFALL OF THE SOUTH OF ENGLAND IN JANUARY, 1906.

THE remarkable dryness of December, 1905, has been followed by a wet month in almost all parts of the country, and more particularly in the south of England. In the east of Scotland alone the rainfall was below the average; over the greater part of Scotland and Ireland the excess was less than 50 per cent., and we have heard of no case in either country in which the fall reached twice the average.

The stations cited in the table on p. 17 are sufficiently uniformly distributed to allow us to take the average of a large group of them as the general rainfall of the area they represent, and by doing so we find that in January, 1906, the general rainfall of Scotland showed an excess of 23 per cent., that of Ireland of 48 per cent., and that of England and Wales of 79 per cent. None of these figures is in any way unusual, for the rainfall of a couple of very wet days may in most places equal the average of a month. A large part of the country is often subjected to more than double the average monthy rainfall, and in January, 1906, this occurred along a pretty wide belt of country from Devon to Norfolk, passing through London, which was relatively the wettest part of the country. The actual figures of rainfall recorded in this belt were somewhat remarkable, and we reproduce a rainfall map of the south of England showing the way in which a rainfall exceeding 5·00 in. prevailed over that part of the country, and that a rainfall of 7·00 in. and upwards spread eastward into the middle of Sussex, and in several a fall exceeding 8·00 inches was recorded.

We are indebted to many correspondents for kindly sending special notes of the remarkably heavy falls, chiefly in eastern Hampshire and western Sussex, and though we only publish a selection, we are equally grateful for all the letters.



The rainfall here in January was 4·46 in., falling on 22 days. It is the greatest in any January since 1877, when I registered 4·93 in. on the same spot, but not by the same gauge.

The January rainfall has already raised the plane of saturation in the chalk in this neighbourhood, on or near the water-parting between the valleys of the Gade and Colne, a little more than two feet.

Weetwood, Watford, Feb. 9th, 1906. JOHN HOPKINSON.

---

		in.
Dec. 30	.....	·02
,, 31	.....	·18
Jan. 1	.....	·68
,, 2	.....	·80
,, 3	.....	·31
,, 4	.....	·73
,, 5	.....	·61
,, 6	.....	·29
,, 7	.....	·32
,, 8	.....	·05
,, 9	.....	·12
,, 10	.....	·01
,, 11	.....	·28
,, 12	.....	·30
,, 13	.....	·21
,, 14	.....	·03
,, 15	.....	·28
,, 16	.....	·42
,, 17	.....	·20
,, 18	.....	·19
,, 19	.....	·01
,, 20	.....	·02

I find that in several places around here there has not been a record of continuous rainfall quite so long or so unbroken as I have noted here. I think that I may therefore send you my experience. I do not remember ever before to have noted 22 *consecutive* days with rain.

W. C. PLENDERLEATH.

Blyth, Dawlish, S. Devon,
Feb. 3rd, 1906.

I send you my notes on rainfall in January. They are somewhat remarkable, constituting a "record" for January during 70 years :—

Total rainfall in January, 1906			9·77 in.	
Average ,, ,, ,, 1834 to 1905...			3·90 ,,	
Previously wet Januaries :—1872	...	7·42 in.	1894	... 6·84 in.
1877	...	8·28 ,,	1904	... 6·82 ,,

Chilgrove, Chichester, 13th Feb., 1906. JOHN W. WOODS.

Rain fell here on twenty-three days in January, the total amount being 7·45 in., and the greatest fall in twenty-four hours 1·22 in. on the 16th. The wettest period was from 1st to 18th, during which there was only one day without rain ; total for eighteen days 6·72 in. Winds S.E. round to W. The ten-years' mean for January is 2·96 in. The wettest January previously recorded at Hazelhurst (the record commenced in 1888) was 6·05 in. in 1904 ; of this amount 3·75 in. fell in the seven days 25th to 31st. The wet period continued until February 17th ; during this part of February 4·27 in. fell—the total for twenty-four consecutive days on that occasion being 8·02 in. Prevailing winds S.W.

T. P. NEWMAN.

Hazelhurst, Haslemere.

		in.
Jan. 1	.....	·25
,, 2	.....	2·50
,, 3	.....	1·00
,, 4	.....	·82
,, 5	.....	·48
,, 7	.....	·70
,, 8	.....	·05
,, 11	.....	·50
,, 12	.....	·57
,, 13	.....	·07
,, 15	.....	·12
,, 16	.....	·65
,, 17	.....	·14
,, 18	.....	·18
		8·03

You may possibly have been overwhelmed with letters *re* the phenomenal rainfall of the first 17 days of January, 1906; but as, at present, I have not heard of any in this neighbourhood, except at Compton (Rev. H. M. Langdale), I write to tell you of my record at Forest Side Vicarage, in West Sussex, close to the border of Hampshire.

From January 1st to 18th my rain gauge has recorded (by daily observations at 9 a.m.) no less than 8·03 in. The *average* January fall for the past 17 years, 1889–1905, is *2·51* in. As you will see, I measured close on that in one day! The wells, which had been very low in 1905, are now rising fast.

MARY B. PARSONS.

19th January, 1906.

P.S.—To complete the record taken here of the rainfall in January, I may add that the total amount for the month is **8·90** in.—M.B.P.

Forest Side Vicarage, Emsworth, Hants, 2nd Feb., 1906.

THE THUNDERSTORM OF FEBRUARY 8th, 1906.

A SEVERE thunderstorm of a somewhat exceptional kind swept over a large part of England on February 8th, causing considerable damage and no little alarm by the sudden outburst of vivid lightning loud thunder and violent hail, accompanied by fierce squalls often more destructive than the lightning. Winter thunderstorms, though common enough in the north-west of Scotland, where thunder is comparatively rare in summer, are so rare in the south-east of England as to arrest public attention, and we have consequently received many letters on the subject, a few of which we are able to reproduce. On this occasion the storm has more interest than always attaches to a stray phenomenon appearing out of due season, and we print first a letter from the Meteorological Office, asking for the records of self-recording instruments during the storm. Unfortunately, we are unable to show a barograph record, for the Redier barograph, with whose virtues and defects our readers must now be fairly familiar, had been taken to pieces eight days before the storm, and the four clocks which enter into its construction had been sent for a much-needed cleaning with a "faithful promise" of return within the week. The cheerful optimism of the skilled workman in his time-estimates is well known, and although we are sure that the barograph will return to its work like a giant refreshed—some time in the future—this particular storm has

meanwhile crept past Camden Square unrecorded barometrically between 2.50 and 3.5 p.m. We hope that some of our readers more fortunately circumstanced will be able to assist the Meteorological Office by sending traces of their barographs and other recording instruments.

We quote only a few of the letters we have received. The newspapers teem with instances of houses struck by lightning or severely damaged by wind, especially in East Anglia. It is interesting to note that the storm was felt in Norwich before 2 p.m., in Watford about 2.30, in London about 2.50, and at Tottingworth Park at 4 p.m. Slender data to found an estimate of rate of travel upon, but the figures suggest a rate of travel twice as fast north of London as south of it.

On the afternoon of Thursday, February 8th, a violent hail squall with much thunder and lightning occurred in the Midlands and the south-east of England, and in London it was accompanied by very striking changes of temperature and pressure.

The Director is of opinion that a detailed examination of the phenomenon in its connexion with the meteorological situation over the country as a whole, would yield interesting results, and he has instructed me to ask whether you would have the goodness to lend him for a short period the traces of your self-recording instruments for this day, or copies of them, and also furnish him with a brief account of any striking meteorological occurrence which may have come under your notice during the day in question. The value of such notes would be greatly increased by stating as accurately as possible the times at which the events took place. Any remarks which would aid in the correct evaluation of the time scale of the automatic records would also be most useful.

R. G. K. LEMPFERT.

Meteorological Office, 63, Victoria Street, London, S. W., 10th February, 1906.

This morning was mild with a spring-like wind from the west. About 1 o'clock I noticed the wind was rising, the sun shining brightly at the time. At 1.30 there was a dark cloud in the west, and a few drops of rain fell and distant thunder was heard. At 1.40 we had a heavy clap of thunder with hail. After about two minutes the hail ceased and snow began to fall thick and fast. At 1.45 there was a strong flash of lightning closely followed by a crashing peal of thunder which seemed to shake the buildings. Another clap of thunder was heard about five minutes afterwards, and then ceased. Snow fell till 2.10 and then the weather cleared up, and at 3.30 the sky was clear and cloudless. Temperature in the shade had been as high as 45°·0 in the morning, but at 2.30 p.m. had gone down to 35°·0. At 9 a.m. the barometer registered 29·883 in., at 1 o'clock it

had gone down to 29·705 in.; it did not fall during the storm, and up to the time of writing (4.45) shows no change either way. We had a heavy fall of snow for a few minutes about 4 o'clock. The sky is now clear and looks like being a sharp frost. Wind calm and still westward. Min. temperatures this week—Sunday, 31°·0; Monday, 27°·0; Tuesday, 21°·0; Wednesday, 23°·0; this morning, 30°·0. The temperature is now 32°·0. The oldest inhabitant does not remember such a heavy thunderstorm in the winter here.

WILLIAM HALL.

Swerford, Oxford, 8th February, 1906.

We had a thunderstorm here with big hail last Saturday night. Thunderstorms in February are very rare here, but *two* in that month are almost unknown. This afternoon from 1.50 to 2.20 we had a thunderstorm which might have been expected in June or July after an outburst of great heat, but which was most extraordinary at this season. The lightning flashes were frequent and brilliant, and the thunder peals followed almost instantaneously Much hail accompanied the lightning, followed by heavy snow whitening the ground. There were only two storms (in June) all last summer of equal violence, and I have never known the like in February before. ARTHUR W. PRESTON.

Christchurch Lodge, Eaton, Norwich, 8th February, 1906.

I see by the papers this morning that the storm was a general and not a local one—all the more unusual at this season. For the purpose of comparison I give you the *time* of the storm here. 1.35 p.m., first thunder; 1.55, storm broke in full fury; 2.10, storm passing; 2.20, last thunder. A. W. P.

9th February, 1906.

A severe, short and remarkably sudden thunderstorm occurred here yesterday afternoon. A few distant peals of thunder were heard from about 2.25, and at 2.28 came a vivid flash of lightning with almost instantaneous thunder, followed by sleet, hail and snow. The storm was over in seven minutes, but the snow continued for some time, leaving the ground white until the following day and yielding ·16 in. of rain.

A man in Watford, with a horse and cart, seeing the storm coming, threw a sack over his shoulders and was about to adjust a nose-bag on his horse, when he was struck and knocked down by an early (probably the first) flash of lightning. He soon recovered, but the horse was brought to its knees and killed instantaneously. It remained so rigid that after the cart had been removed it had to be shoved over on to its side. JOHN HOPKINSON.

Weetwood, Watford, 9th February, 1906.

A storm of thunder, lightning and hail, lasting 15 minutes, passed overhead at 4 p.m. yesterday. The melted hail measured ·11 in. The lightning struck a tree and a telegraph pole about one mile south of this place. J. MASSON.

Tottingworth Park Gardens, Heathfield, Sussex, February 9th, 1906.

Correspondence.

THE PACKING OF METEOROLOGICAL INSTRUMENTS.

To the Editor of Symons's Meteorological Magazine.

THOSE of us who are privileged to control a meteorological service, however primitive it may be, find a deal to try our patience. Our troubles spring from many sources, but I wish to draw your attention to two, which may be interesting because they may not be so universal as other sources.

In the forefront of offenders I should place those who pack instruments for export. That the trouble is in the packer and not in the instruments is proved by my experience during the last few years in one of our colonies. I have had to unpack considerable quantities of apparatus for the teaching of Physics and Chemistry, such as a quadrant electrometer, several galvanometers, several Beckmann thermometers, X-ray tubes and glass ware of every description. The breakages have been few and trifling. But in the same time I have unpacked several consignments of meteorological instruments from several British firms and the number of breakages has been abnormally high. Fully fifty per cent. of the Kew barometers have been broken. Grass minimum thermometers especially suffer, the guard tube breaking. A nephoscope was packed with the compass needle *in situ* under the mirror! Result: a broken mirror, a broken agate and a broken pivot! One large case, containing a heterogeneous collection of rain gauges, an evaporation gauge, a barograph and a Campbell-Stokes sunshine recorder, came to hand with the packing sunk a good six inches below the lid. The evaporation gauge was beyond recognition, the barograph was so knocked about as to be almost useless. In another case a self-recording instrument had the drum removed, leaving the spindle projecting some three inches. It was bent through an angle of 30°. I need not mention breakages amongst such small fry as dry and wet bulb and maximum and minimum thermometers. They do not escape the general *debâcle*.

My advice to the packer is to take all instruments to pieces and pack the various pieces in small boxes, which may then be packed in one large case. This advice must be followed particularly in the case of so-called portable instruments. The ratio of packing material to instruments should be as 4 : 1.

Another source of trouble is the design of the instruments. The colony I speak of is exceedingly dry and dusty. The aforementioned nephoscope will illustrate what I mean, and the defect may be found also in theodolites, levels and dip needles. I refer to the electrification caused by wiping the mirror, even with one's hand. The compass needle being in close proximity to the mirror will point anywhere but North. In this connection I may tell you that in that climate black and bright bulbs may be tested for vacuum by simply drawing the hand over them. The whole interior glows like a Geissler tube, if the vacuum is good. The dry and wet bulb in the hands of an observer who simply takes readings must be a very misleading instrument, as between dust and drought the cotton cannot be relied on to keep the bulb wet.

Such a useful instrument as the Kew barometer is not reliable. I question if the constriction is worth retaining. It is there the tube breaks. The constriction must also be a cause of the sluggishness of the instrument. I have found a Fortin Standard more portable and more reliable in many ways.

A. W.

NOTE ON THE MODE OF FORMATION OF RAIN.

WHILST walking across the ridge of Ashdown Forest this morning in a storm of wind and rain, one of this prolonged series, I was especially struck both by the peculiar manner in which the rain seemed to grow out of the air, and by the apparent fact that the rain executed a complicated spiral movement before finally reaching the ground. I have repeatedly observed the phenomena to the best advantage perhaps among the higher hills of England which afford excellent back-grounds for observing similar effects. In such cases as this the eye can never, of course, attempt to analyse the motion of the rain drops, but it can perceive that it is of an exceedingly complicated nature.

It would seem that in cyclonic storms of this nature there is no line of demarcation between the rain zone and the cloud zone, the one merging imperceptibly into the other, rain being distinguished from cloud only by the greater size of the water-drops composing it. Very different is the rain which falls in showers and thunderstorms. Then the clouds seem to have some analogy to a saturated sponge. when it is suddenly compressed, the water falling in streams from this under surface, and the boundary between rain and cloud is often quite well defined by characteristic black streaks. Furthermore the cloud-density in heavy showers and thunderstorm rains must, on the whole, be very much greater than in the cyclonic rains of winter, and the inky-blackness of a thunder sky is very distinct from the dull grey-blackness of the more diffused clouds of large cyclonic storms.

L. C. W. BONACINA.

Forest Row, Sussex, January 18th, 1906.

GREEN FLASH AT SUNSET.

SURELY the phenomenon described by your correspondent, Admiral Maclear, is a physiological phenomenon of colour due to contrast. The green flash seen as the last ray of the setting sun disappears is the apparent image or spectrum of the sun which has just sunk below the horizon seen in the complementary green colour.

This phenomenon may be illustrated by the following experiment:—"Let a small piece of bright red paper be held before a moderately lighted white surface; let the observer look steadfastly at the small piece of coloured paper, and let it be taken away after a time, while his eyes remain unmoved; a green spectrum will then be visible on the white surface. The coloured paper may also be left in its place, while the eye is directed to another part of the white surface, the same coloured appearance will be visible there too, for it arises from an image, which now belongs to the eye," see Goethe, "Zur Farbenlehre," vol. i., pp. 49, 50, 54.

The reason why some observers may describe the colour of the flash as blue is due to the fact that the colour of the setting sun or planet is sometimes of a yellow-red or orange colour, the complementary colour of which is blue.

R. C. CANN LIPPINCOTT.

Over Court, Almondsbury, Bristol, January 20th, 1906.

WITH reference to "the green flash," I saw it continually on my way from Tasmania, in 1854, in the South Pacific. But it then occurred at *sunrise*. I used to get up to observe it morning after morning. I do not think I ever witnessed it at sunset.

GEORGE H. COURTENAY.

Southtown House, Kenton, nr. Exeter, January 19th, 1906.

[Major Courtenay's observation of the green ray at sunrise, *i.e.*, *before* the sun appears, seems to dispose of Mr. Lippincott's argument that the appearance is due to fatigue of the eye suggesting the complementary colour, a suggestion often made before seeing the phenomenon but rarely upheld by one who has actually observed it. We reserve further comment until the promised article on the subject appears.—ED. *S.M.M.*]

ROYAL METEOROLOGICAL SOCIETY.

THE Annual General Meeting of this Society was held on Wednesday, January 17th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

The Council, in their Report, stated that the new scheme of Lectures and Exhibitions had been successfully inaugurated during the year, and that they had appointed Mr. W. Marriott as the Lecturer. The work of the Kite Committee had been continued, the special observations being carried out by Mr. G. C. Simpson, on board the mission steamer *Queen Alexandra* in the North Sea. The number of Fellows was 674, being an increase of 16 in the year.

The Report having been adopted and the usual votes of thanks passed, the President read from the Council minutes a statement of Lieut.-Gen. Sir Richard Strachey's services to Meteorology, and then in a few appropriate words handed the Symons Gold Medal to Dr. W. N. Shaw, on behalf of Sir R. Strachey, who had written expressing his great regret that he was unable to attend and receive it in person.

The President then delivered an address on "Meteorology in Daily Life." He referred to the increasing interest being shown throughout the country in the study of Meteorology, and to the recent advances which had been made in the science, more especially in the analysis of the composition of the atmosphere, and in the investigation of the upper air. He laid stress on the increasing urgency of safeguarding the water supply of the country, pointing out that, while in the reign of William the Conqueror there were barely two millions of inhabitants in these islands and no water was then used for sanitation or manufactures—to-day the population has risen to over forty-two millions, and a large proportion of the land had either been drained or built over. In the course of his address Mr. Bentley touched upon a large number of meteorological topics and gave various illustrations of the effects of weather on human life, animals, vegetation, agriculture, food, navigation, and railways.

A vote of thanks having been passed to the President for his address, the scrutineers of the ballot announced that the following gentlemen had been elected the Officers and Council for the ensuing year:—

President—Mr. R. Bentley. *Vice-Presidents*—Capt. W. F. Caborne, C.B., Mr. F. Druce, Sir J. W. Moore, and Capt. D. Wilson-Barker. *Treasurer*—Dr. C. T. Williams. *Secretaries*—Mr. F. C. Bayard and Dr. H. R. Mill. *Foreign Secretary*—Dr. R. H. Scott, F.R.S. *Council*—Mr. J. E. Clark, Mr. R. H. Curtis, Mr. W. H. Dines, F.R.S., Mr. W. Ellis, F.R.S., Capt. M. W. C. Hepworth, C.B., Mr J. Hopkinson, Mr. R. Inwards, Mr. B. Latham, Mr. E. Mawley, Mr. H. Mellish, Dr. W. N. Shaw, F.R.S., and Mr. C. T. R. Wilson, F.R.S.

The Annual General Meeting was preceded by a brief Ordinary Meeting, at which the following gentlemen were elected Fellows:—Rev. I. K. Anderson, Sir Hugh Bell, Bart., Capt. F. Coode, Mr. C. H. Gott, Mr. C. H. Grant, Mr. M. W. Hilton-Simpson, Dr. K. W. Kumm, Mr. A. T. Millroy, and Mr. M. Thakado.

METEOROLOGICAL NEWS AND NOTES.

THE WEEKLY WEATHER REPORT of the Meteorological Office has undergone change and improvement with the beginning of the current year. The front page contains general remarks on the weather for the week over the British Isles and a general statistical summary of the temperature, rainfall and sunshine for each of the forecasting districts in three sections—the first dealing with the week just elapsed, the second with the season, the third with the current year—so far as they have respectively gone. The second page contains the values for the individual stations from which the summary has been compiled. The next three and a half pages contain, as formerly, three weather-maps of Europe for each day of the week just past, the map of temperature and weather at 8 a.m. and those of barometer and wind at 8 a.m. and 6 p.m. The second half of the last page is devoted to a supplementary table of sunshine, and —the most striking and valuable innovation—a table of observations in the upper air, taken by means of kites at the Meteorological Office's kite stations at Oxshott, and elsewhere during the week to which the Report refers. To all who have read Dr. Shaw's paper on "Seasons in the British Isles," recently published by the Royal Statistical Society, the new form of the Weekly Weather Report will appeal with special force.

THE SCIENCE YEAR BOOK, edited by Major B. F. S. Baden-Powell, is one of those books a review of which was crowded out of our last issue, but although it is now late in the year to invest in a diary, we can commend the text of this conveniently arranged handbook as worth the cost of it. It contains a great amount of useful information and abounds with ingenious modes of arrangement, the originality and efficiency of which are very refreshing to meet with.

A LEADING ARTICLE IN "THE TIMES" of February 5th, calls attention to the harm that is done by the exaggerated ideas prevailing as to the frequency of destructive atmospheric disturbances. The particular case is one which admits of the only argument comes home to the unscientific mind, that of adding up and reducing to pounds, shillings and pence. Mr. Hesketh Bell, who had held an administrative office in the West Indies, pointed out that the rates of insurance against hurricanes were so high as to deter planters and farmers from protecting themselves against the calamitous results of these storms, and he showed that this arises from the exaggerated idea entertained by the insurance offices as to the frequency of hurricanes. In consequence of these representations new rates of insurance of crops in the West Indies against hurricanes, have been drawn up, bananas being excluded on account of their more ready destruction by wind, and it is believed that both planters and insurance companies will profit by the result.

CAN ANY OF OUR READERS tell us of a house with grounds suitable for kite experiments on a large scale, or near an expanse of open country in a thinly peopled district, within two hours by rail of London, as far as possible from the sea?

REVIEWS.

Travaux de la Station Franco-Scandinave de Sondages aëriens à Hald, 1902—1903. [Work of the Franco-Scandinavian Station for aërial soundings at Hald for 1902—1903]. Viborg: 1904. Size 12½ × 10. Pp. 52 + 162. Plates.

ON the initiative of M. Teisserenc de Bort it was resolved in 1901 to establish a station at which for several months continuous observations could be made, day and night, of the meteorological conditions of the upper air. The place selected for this purpose was Hald, near the little town of Viborg, in the centre of the peninsula of Jutland, and the governments of Denmark and Sweden assisted in the work, which was commenced in May, 1902, and continued for a whole year. M Teisserenc de Bort writes the introduction to this report, Professor Hildebrandsson follows with an account of the organization of the station, which shows that half the cost was borne by M. Teisserenc de Bort, and that a Danish landed proprietor, Mr. A. Krabbe, gave the use of part of his estate free of charge for the installation of the station. Other participators in the work describe their special share. Various sheds, workshops, and a villa for the assistants were put up, and the complete staff included 6 meteorologists, 1 computor, 1 watchmaker, 5 mechanics, 1 foreman, 6 carpenters or kite makers, 6 men in three watches of two each, 1 coachman, and 1 labourer—a total of 28 all told.

Ascents were made almost every day and the kites were kept up for a very long time, frequently for more than twenty consecutive hours in a single experiment. *Ballons-sondes*, or small free balloons, carrying meteorographs with an arrangement to secure their fall after a definite interval of time, were also used, and of those sent up 80 per cent. were recovered. In addition, on several occasions ascents were made from ship-board in the adjacent sea. The bulk of the volume before us is occupied with the data of the various ascents reduced from the curves of the meteorographs, and it constitutes an immense storehouse of raw material for subsequent study.

Ueber die Energie der Stürme. [On the Energy of Storms]. Von MAX MARGULES. Wien: 1905. Size 12 × 9. Pp. 26.

THIS mathematical discussion of the energy of storms is reprinted from the annual publication of Central Institute for Meteorology in Vienna for 1903.

The State of the Ice in the Arctic Sea, 1904. [Copenhagen: 1905]. Size 12 × 9½. Pp. xvi. Plates.

THE Danish Meteorological Institute are punctual in the publication of this important series of monthly charts showing the distribution of ice in the North Atlantic and Arctic Sea during the open season of 1904. The winter of 1903-04 was found to be milder than usual to the north of the Atlantic, and in 1904 the East Greenland Current brought rather less and the Labrador Current considerably more ice than usual into the Atlantic.

The Floods of the Spring of 1903 in the Mississippi Watershed. By H. C. FRANKENFIELD. Washington Weather Bureau, 1904. Size 11½ × 9½. Pp. 64. Plates.

THE floods in question, produced by the heavy rainfall of February, 1903, affected the river for three months. The rise of water was unprecedented in many places, and the numerous photographs illustrating the memoir give a vivid idea of the damage done.

La représentation des situations atmosphériques. Par A. BRACKE. Mons: 1904. Size 10 × 6½. Pp. 32. Plates.

As heights in a country may be represented either by contour lines on a map or by a succession of sections, so M. Bracke proposes to represent atmospheric conditions by a series of sectional diagrams instead of the usual cartographic representation of isobars and isotherms.

La Théorie hydrothermodynamique des Tourbillons atmosphèriques en face du problème des variations de la température de l'air. [The hydrothermodynamic theory of atmospheric whirls and the problem of the variations of the temperature of the air.] Par R. P. MAX DECHEVRENS, S.J. Jersey: 1905. Size 8½ × 5½. Pp. 36.

IN 1879 Father Dechevrens put forward a theory of atmospheric whirls in which he looked upon the cyclone and anticyclone as parts of one whole, one being always superimposed upon the other and separated by a stratum of air at an elevation of from 18,000 to 21,000 feet. In 1886 he showed how mountain observations confirmed his view, and now he finds in the kite and balloon work recently undertaken still more ample confirmation of the correctness of a theory which proves applicable to all the facts regarding the distribution of temperature in cyclones and anticyclones at ground level and throughout all heights in the atmosphere.

TEMPERATURE FOR JANUARY, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [* E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32° Shade.	Grass
		° ′	° ′							
Camden Square	*London*	51 32	0 8	111	53·0	26	25·3	23	8	16
Tenterden	*Kent*	51 4	*0 41	190	52·5	5	23·5	24	26	15
Hartley Wintney	*Hampshire*	51 18	0 53	222	58·0	13, 14	24·0	23, 24	10	12
Hitchin	*Hertfordshire*	51 57	0 17	238	51·0	4, 27	25·0	22, 23	8	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	53·0	27	26·0	20, 23	9	18
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	55·0	27	25·0	23	9	...
Brundall	*Norfolk*	52 37	*1 26	66	...	..	...	...	...	...
Alderbury	*Wiltshire*	51 2	1 44	263	54·0	26	20·0	23	12	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	52·1	5	21·0	24	8	10
Torquay (Cary Green)	*Devon*	50 28	3 32	12	54·4	5	29·8	24	2	15
Polapit Tamar [Launceston]	,,	50 40	4 22	315	54·1	5	22·8	24	7	9
Bath	*Somerset*	51 3	2 22	67	56·0	26	24·0	24	9	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	56·0	3 †	28·0	22	7	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	51·0	26	22·5	1	18	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	50·0	27	22·0	23	11	...
Boston	*Lincolnshire*	52 58	0 1	25	52·0	27	25·0	23	8	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	56·7	27	26·6	23	6	22
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	54·0	27	24·0	23	6	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	49·4	28	29·4	1	3	15
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	..
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	54·0	28	30·0	20, 22	2	19
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	49·7	26	28·2	22	4	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	..	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	51·7	3	24·3	23	3	12
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	...	...	...	...	...	...
Llandudno	*Carnarvon*	53 20	3 50	72	57·0	4	34·0	1	0	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	52·0	27	28·0	22	4	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	49·0	27	26·0	21	...	23
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	50·1	28	28·0	1	3	8
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	50·0	26, 28	26·0	21	2	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	49·0	26, 27	28·0	21	6	26
Tighnabruaich	*Argyll*	55 55	5 14	50	44·0	3, 26	28·0	19, 21	7	9
Mull (Quinish)	,,	56 36	6 13	35	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	53·2	26	27·0	22	8	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	57·0	26	28·0	7, 22	15	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	54·5	26	28·0	8	14	...
Castletown	*Caithness*	58 35	3 23	100	47·0	21, 27	25·0	8	14	16
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	55·0	29	29·0	20	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	52·0	3 ‡	23·0	23	6	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	49·0	27	26·0	19, 22	6	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	54·9	28	29·0	23	2	11
Ballinasloe	*Galway*	53 20	8 15	160	58·0	27	24·0	20	16	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	..
Seaforde	*Down*	54 19	5 50	180	52·0	26	27·0	20	5	13
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	50·0	2 §	28·0	21	7	13

† and 5, 26 and 27. ‡ and 4, 26 and § and 24, 26 and 28.

RAINFALL FOR JANUARY, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
ver. '0-99. in.	1906. in	Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1870-99. in.	1906. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1870-1899. in.	STATION.
·89	4·02	+2·13	213	·74	12	18	...	...	...	...	25·16	Camden Square
·36	3·64	+1·28	154	·55	4	20	...	...	...	...	28·36	Tenterden
·39	4·34	+1·95	182	·69	16	22	...	...	...	...	27·10	HartleyWintney
·81	3·54	+1·73	196	·53	4	20	...	...	...	...	24·66	Hitchin
·05	3·67	+1·62	179	·60	5	21	...	...	...	...	26·75	Addington
·70	3·64	+1·94	214	·50	4	22	...	...	...	..	25·39	Westley
·67	3·94	+2·27	236	·57	5	23	...	...	..	...	25·40	Brundall
·67	5·65	+2·98	212	·68	1	19	...	...	...	...	29·17	Alderbury
·90	8·91	+5·01	228	1·42	2	24	...	...	...	...	39·00	Winterbourne Stpltn
·19	6·21	+3·02	194	·77	16	20	...	...	...	...	35·00	Torquay
·87	7·46	+3·59	193	·88	2	24	...	...	...	...	38·85	Polapit Tamar
·52	4·26	+1·74	169	·65	12	21	...	...	...	...	30·75	Bath
·46	4·71	+2·25	191	·69	5	21	...	...	...	...	29·85	Stroud
·81	4·16	+1·35	148	·85	5	23	...	...	...	...	33·04	Woolstaston
·91	3·54	+1·63	185	·59	5	18	...	...	..	..	24·50	Bromsgrove
·59	2·44	+ ·85	153	·40	6, 7	18	...	...	...	...	23·30	Boston
·74	2·91	+1·17	167	·56	7	17	...	...	...	..	24·70	Hodsock Priory
·95	3·28	+1·33	168	·66	5	23	...	...	...	...	26·18	Derby
·38	6·47	+3·09	191	·84	5	25	...	...	...	...	42·43	Bolton
·89	3·95	+2·06	209	·88	16	21	...	...	...	...	26·96	Ribston Hall
·33	9·96	+3·63	157	1·82	28	28	...	..	...	...	60·96	Arncliffe Vic.
·80	2·50	+ ·70	139	·44	5, 7	19	...	...	...	...	27·02	Hull
·96	2·42	+ ·46	123	·63	18	22	...	...	...	...	27·99	Newcastle
·71	19·93	+5·22	135	6·15	28	28	...	...	...	...	132·68	Seathwaite
·85	7·57	+3·72	197	·80	5	26	...	...	...	...	42·81	Cardiff
·13	7·34	+2·21	143	1·10	5	23	...	...	...	...	47·88	Haverfordwest
·87	...	..	...	...	...	...	...	...	...	...	45·41	Gogerddan
·57	3·88	+1·31	151	·91	5	21	...	...	..	...	30·98	Llandudno
·54	4·84	+ ·30	107	·92	28	24	..	...	...	...	43·43	Cargen
·60	2·98	+ ·38	115	·51	11	26	...	...	...	...	33·04	Riddell House
...	3·11	...	...	·87	28	16	...	...	...	...	...	Edinburgh
·52	4·90	+ ·38	108	·60	14	25	..	...	...	...	44·85	Colmonell
·25	4·77	+1·52	147	·70	28	24	...	...	...	...	35·80	Glasgow
·86	7·20	+1·34	123	·67	11	27	...	...	...	...	57·90	Tighnabruaich
·85	6·81	+ ·96	116	1·02	14	29	...	..	...	...	57·53	Quinish
·10	2·05	— ·05	98	·45	28	15	...	...	..	...	28·95	Dundee
·91	3·63	+ ·72	125	..	...	...	...	...	...	...	36·07	Braemar
·32	1·57	— ·75	68	·34	3	14	...	...	...	...	33·01	Aberdeen
·14	2·76	+ ·62	129	·67	14	21	...	...	...	...	29·37	Cawdor
·63	12·73	+6·10	192	2·15	24	20	...	...	...	...	56·00	Invergarry
·75	14·70	+5·95	168	2·10	28	29	...	...	...	...	86·50	Bendamph
·62	2·87	+ ·25	110	·41	24	15	...	...	...	...	31·60	Dunrobin Castle
...	2·75	...	...	·36	10	25	...	...	...	...	...	Castletown
·57	6·36	— ·21	97	·84	11	25	...	...	...	...	58·11	Killarney
·06	4·86	+ ·80	120	·80	5	20	...	...	...	...	39·30	Waterford
·98	5·36	+2·38	180	·80	17	25	...	...	...	...	33·47	Hurdlestown
·15	3·86	+ ·71	123	·57	17	19	...	...	...	...	34·44	Carlow
·16	4·13	+1·97	191	·64	2	22	...	...	...	...	27·75	Dublin
·49	5·70	+2·21	163	·57	11	27	...	...	...	...	37·04	Ballinasloe
·86	11·08	+3·22	141	1·33	15	25	...	...	...	...	80·23	Kylemore House
·00	7·08	+2·08	142	1·27	11	27	...	...	...	...	50·50	Enniscoe
·63	3·97	+ ·34	109	·67	7	24	...	...	...	...	38·61	Seaforde
·56	5·77	+2·21	162	1·03	28	29	...	...	...	...	41·20	Londonderry
·34	5·34	+2·00	160	·70	14	27	...	...	...	...	37·85	Omagh

SUPPLEMENTARY RAINFALL, JANUARY, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	5·45	XI.	Rhayader, Tyrmynydd	11·18
,,	Ramsgate, West Cliff Villas	2·18	,,	Lake Vyrnwy	9·30
,,	Hailsham	5·23	,,	Llangyhanfal, Plâs Draw	4·39
,,	Crowborough, Uckfield Lodge	6·74	,,	Criccieth, Talarvor	5·65
,,	Osborne, Newbarn Cottage.	7·05	,,	Llanberis, Pen-y-pass	22·32
,,	Emsworth, Redlands	7·73	,,	Lligwy	4·13
,,	Alton, Ashdell	7·23	,,	Douglas, Woodville	4·81
,,	Newbury, Welford Park	5·55	XII.	Stoneykirk, Ardwell House	3·77
III.	Harrow Weald, Hill House.	3·74	,,	Dalry, The Old Garroch	8·59
,,	Oxford, Magdalen College..	3·16	,,	Langholm, Drove Road	6·73
,,	Bloxham Grove	3·97	,,	Moniaive, Maxwelton House	5·73
,,	Pitsford, Sedgebrook	3·79	XIII.	N. Esk Reservoir [Penicuick]	4·95
,,	Huntingdon, Brampton	3·38	XIV.	Maybole, Knockdon Farm..	4·21
,,	Wisbech, Bank House	3·12	,,	Campbeltown, Witchburn...	5·52
IV.	Southend Water Works	3·09	XV.	Inveraray, Newtown	9·13
,,	Colchester, Lexden	2·77	,,	Ballachulish House	16·78
,,	Newport, The Vicarage	3·55	,,	Islay, Eallabus	6·12
,,	Rendlesham	3·54	XVI.	Dollar Academy	4·74
,,	Swaffham	3·65	,,	Loch Leven Sluice	4·47
,,	Blakeney	3·23	,,	Balquhidder, Stronvar	12·96
V.	Bishops Cannings	3·97	,,	Perth, Pitcullen House	3·30
,,	Ashburton, Druid House	11·00	,,	Coupar Angus Station	2·95
,,	Okehampton, Oaklands	7·72	,,	Blair Atholl	4·68
,,	Hartland Abbey	6·13	,,	Montrose, Sunnyside Asylum	2·02
,,	Lynmouth, Rock House	7·59	XVII.	Alford, Lynturk Manse	1·97
,,	Probus, Lamellyn	6·10	,,	Keith Station	1·28
,,	Wellington, The Avenue	5·55	XVIII.	N. Uist, Lochmaddy	3·43
,,	North Cadbury Rectory	5·14	,,	Alvey Manse	2·82
VI.	Clifton, Pembroke Road	4·95	,,	Loch Ness, Drumnadrochit.	6·37
,,	Moreton-in-Marsh, Longboro'	4·77	,,	Glencarron Lodge	15·62
,,	Ross, The Graig	4·08	,,	Fearn, Lower Pitkerrie	1·89
,,	Shifnal, Hatton Grange	3·42	XIX.	Invershin	3·51
,,	Cheadle, The Heath House.	4·94	,,	Altnaharra	7·49
,,	Coventry, Kingswood	3·59	,,	Bettyhill	3·81
VII.	Market Overton	4·00	,,	Watten Station	1·86
,,	Market Rasen	2·73	XX.	Dunmanway, The Rectory..	8·92
,,	Bawtry, Hesley Hall	2·36	,,	Cork	5·42
VIII.	Neston, Hinderton	4·76	,,	Darrynane Abbey	7·65
,,	Southport, Hesketh Park	4·08	,,	Glenam [Clonmel]	5·21
,,	Chatburn, Middlewood	6·95	,,	Ballingarry, Gurteen	4·07
,,	Cartmel, Flookburgh	5·83	,,	Miltown Malbay	6·50
IX.	Langsett Moor, Up. Midhope	6·04	XXI.	Gorey, Courtown House	4·17
,,	Scarborough, Scalby	4·51	,,	Moynalty, Westland	4·56
,,	Ingleby Greenhow	3·45	,,	Athlone, Twyford	5·34
,,	Mickleton	3·49	,,	Mullingar, Belvedere	4·29
X.	Bardon Mill, Beltingham	3·64	XXII.	Woodlawn	6·59
,,	Ewesley, Fallowlees	3·45	,,	Westport, Murrisk Abbey..	7·54
,,	Ilderton, Lilburn Cottage..	1·91	,,	Collooney, Markree Obsy..	5·92
,,	Keswick, York Bank	8·85	XXIII.	Enniskillen, Portora	4·06
XI.	Llanfrechfa Grange	7·53	,,	Warrenpoint, Summer Hill.	3·98
,,	Treherbert, Tyn-y-waun	15·93	,,	Banbridge, Milltown	2·58
,,	Carmarthen, The Friary	8·09	,,	Belfast, Springfield	4·72
,,	Castle Malgwyn [Llachryd].	7·05	,,	Bushmills, Dundarave	3·96
,,	Plynlimon	16·05	,,	Stewartstown, The Square..	3·54
,,	Tall-y-llyn	5·60	,,	Killybegs	7·75
,,	New Radnor, Ednol	6·99	,,	Horn Head	6·97

METEOROLOGICAL NOTES ON JANUARY, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder: L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Mild and excessively wet, the R having been only once exceeded and once equalled in January in 49 years. Mean temp. 41°·9, or 3°·8 above the average. A short but violent TS occurred on 9th, accompanied by showers of H and great darkness, and there was again extraordinary darkness from 10 to 11.40 a.m. on 23rd. Duration of sunshine 43·3* and of R 62·5 hours, the latter being 21·2 hours above the average.

TENTERDEN.—Wet and warm with a great deal of wind. Duration of sunshine 77† hours,

CROWBOROUGH.—Mild, stormy and wet. R 3·56 in. above the average of 35 years and mean temp. 40°·0, or 3°·5 above the average.

OSBORNE.—The largest R in any January in 48 years.

ADDINGTON MANOR.—The R was the largest with two exceptions yet recorded and big floods covered the meadows for days. The wind was often very high and several large trees were blown down.

BURY ST. EDMUNDS.—The wettest January in 50 years.

TORQUAY.—Duration of sunshine 80·5* hours, or 17·6 hours above the average. Mean temp. 45°·4, or 3°·1 above the average. Mean amount of ozone 5·5.

CLIFTON.—Wet and stormy till 18th owing to a series of depressions from the Atlantic. The remainder was fine but changeable. Very mild throughout. Tremendous gale from W. on the early morning of 6th, doing much damage to roofs and trees.

BOLTON.—Mean temp. 40°·7, or 2°·6 above the average. Duration of sunshine 19·1* hours, or 2·2 hours below the average. The R was particularly heavy, but most of it fell during the nights, the day time being fair and often bright.

HAVERFORDWEST.—Mild with no extremes of temp. Severe gales, especially on 6th and 15th, with large R. Duration of sunshine 49·6* hours. Primroses, violets and other flowers in bloom.

DOUGLAS.—Wet, very mild and exceedingly stormy. Snowdrops, primroses, polyanthus and crocus were in flower, and currants and pears showed bloom unusually early. S on 18th with T, L and H.

LANGHOLM.—R 2·08 in. above the average of 30 years.

COUPAR ANGUS.—Exceptionally mild, the mean temp. being 39°·5, or 4°·0 above the average, making the second month in succession with abnormally high temp. Persistent wet weather.

DRUMNADROCHIT.—R 2·60 in., and rainy days 2·5, above the average of 20 years, the amount being the greatest in that period except in 1903. Destructive flood on 14th caused by melting S on the hills. Floods again on 24th and 27th. Great damage to river banks, roads and cultivated land.

CASTLETOWN.—Open, dull and cloudy, with westerly winds, slight frosts and no S. Mean temp. 36°·9. Shrubs beginning to sprout.

DARRYNANE ABBEY.—A wet month, especially in the first part, the fall up to 15th being equal to the average and the total 40 per cent. above the average, being exceeded only three times in 25 years.

DUBLIN.—W. and S.W. winds and heavy and frequent R with open but not warm weather. Mean temp. 43°·9, or 2°·3 above the average. Atmospheric pressure was very unstable during the first three weeks.

BANBRIDGE.—R ·01 in. below the average of 40 years.

OMAGH.—A saturating month with abnormal mildness. It could not be said that the ground was once wholly covered with S, and such frost as there was was of a light and ephemeral character.

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* Campbell-Stokes. † Jordan

Climatological Table for the British Empire, August, 1905.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	78·1	15	45·4	24	72·1	53·2	53·5	77	126·9	38·1	2·24	16	6·4
Malta	96·2	29	66·6	24	87·8	71·6	70·8	75	141·8	61·7	·00	0	1·0
Lagos	84·0	17*a*	70·0	5*b*	81·5	72·8	70·1	76	140·0	62·0	·49	7	7·5
Cape Town	76·4	11	38·2	15	60·6	46·2	45·8	73	...	...	3·06	14	4·0
Durban, Natal	84·2	14	47·2	9	72·9	54·4	...	...	137·3	...	1·29	13	4·6
Johannesburg	73·0	31	34·7	25	63·2	42·6	36·5	64	138·0	20·5	·06	2	2·2
Mauritius	78·5	18	52·3	2	75·7	60·6	58·9	74	140·8	44·9	2·35	14	6·3
Calcutta	91·5	24	74·9	13	88·6	79·7	78·4	86	158·1	73·4	6·31	15	8·8
Bombay	87·6	31	75·3	24	85·6	77·9	76·0	83	135·0	73·8	4·35	23	8·2
Madras	101·2	21	72·7	2	95·4	77·8	72·6	72	151·3	71·3	1·92	11	5·8
Kodaikanal	68·4	6	50·1	4	64·4	52·7	51·1	80	144·6	40·4	8·54	17	6·5
Colombo, Ceylon	89·0	7	76·5	22	87·5	78·7	74·5	80	153·5	74·8	·59	10	6·0
Hongkong	90·5	14	73·0	1	86·7	77·3	75·7	84	146·8	...	12·12	15	6·8
Melbourne	65·5	4, 25	32·0	2	58·3	43·0	40·4	71	120·0	24·5	1·33	12	6·2
Adelaide	68·8	4	34·8	21	59·5	43·5	41·8	71	126·3	30·3	1·48	15	5·4
Coolgardie	76·0	31	32·4	11	62·4	39·3	36·7	58	144·9	24·6	·54	4	2·8
Sydney	76·9	20	40·4	10	62·4	46·4	41·2	72	109·8	30·5	·63	22	3·1
Wellington	62·8	16	32·5	30	54·2	43·2	39·1	69	109·0	28·0	2·73	19	6·1
Auckland	60·5	19	39·5	11	56·9	46·2	45·8	82	115·0	36·0	3·05	15	5·7
Jamaica, Negril Point	91·0	21	71·3	29	87·8	73·9	73·8	78	...	...	5·45	10	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	89·4	13	71·0	31	84·5	75·0	72·0	78	145·4	...	11·64	25	3·4
Toronto	83·8	10	48·9	17	77·4	57·7	59·0	76	...	36·8	4·22	4	4·4
Fredericton	88·7	12	35·4	15	75·6	49·5	50·8	56	...	...	1·60	8	5·2
Winnipeg	84·4	22	43·5	31	76·5	54·4	...	...	...	...	1·41	12	5·5
Victoria, B.C.	78·4	8	46·9	25	65·9	52·9	...	...	...	...	1·21	7	3·7
Dawson	80·0	1	26·4	27	66·4	44·3	...	...	...	...	2·51	9	5·2

a and 21. *b* and 9, 27.

MALTA.—Mean temp. of air 79°·1, or 1°·0 above average. Mean temp. of sea 81°·7.

Durban.—R ·64 in. below the average of 30 years.

Mauritius.—Mean temp. of air 0°·3, and dew point 0°·5 below, and R ·09 in. above, averages. Mean hourly velocity of wind 9·8 miles, or 2·5 below average.

MADRAS.—Deficient R, with persistent N.W. winds. Bright sunshine 154·2 hours.

KODAIKANAL.—Bright sunshine 150 hours. Very many TSS.

COLOMBO.—Mean temp. of air 82°·4, or 1°·6 above, of dew point 1°·3 above, and R 3·11 in. below, averages. Mean hourly velocity of wind 10·0 miles.

HONGKONG.—Mean temp. of air 81°·2. Mean direction of wind E.S.E., and mean hourly velocity 9·3 miles. Bright sunshine 223·4 hours.

Adelaide.—Mean temp. of air 2°·4 below, R ·84 in. below 48 years' average. The coldest August, with one exception (1872, 49°·9).

Sydney.—R 2·54 in. below; mean temp. 0°·4 below, average.

Wellington.—R 2·31 in. below average.

Auckland.—R 1·25 in. below average.

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THE GREEN FLASH ON THE HORIZON.

By Arthur A. Rambaut, D.Sc., F.R.S.

Is the "green flash" at sunset a real objective change in the character of the light which reaches us from the sun just before its disappearance, or is it a subjective effect due to fatigue of the retina?

Several references to this interesting occurrence have lately appeared in the pages of *Symons's Meteorological Magazine*, and a good deal of doubt seems to be entertained in some quarters as to its objective character. It will, therefore, be well to examine what is known about it.

Of recent years this phenomenon has been frequently observed, and many descriptions of it will be found scattered through the pages of various scientific periodicals. The first account of the appearance, with which I am acquainted, is published in *Nature*, Vol. 29, p. 7. The Rev. G. H. Hopkins, of Week St. Mary Rectory, Cornwall, writes—"In a clear sky, as the disk of the sun sinks down below the horizontal line of the ocean, the parting ray is a brilliant emerald green. I have occasionally, but not often, had the pleasure of seeing this interesting phenomenon, as the clear atmosphere has to be accompanied with a cloudless region of the sky where the sun is setting. The same effect is not produced by the sun setting behind a distant bank of clouds. Probably the first ray from the rising sun would be the same unexpected colour."

On p. 76 of the same volume Mr. William Swan describes a similar appearance as seen by him at sunrise from the summit of the Rigi on September 13th, 1865. He writes—"The very first rays, although necessarily proceeding from the comparatively obscure limb of the sun, were dazzlingly brilliant and of a superb emerald green colour . . . . In *Nature*, Vol. xli. p. 495, will be found a notice of Prof. Sohncke's views with regard to the phenomenon, and on p. 538 of the same volume is a letter from Prof. Michie Smith dealing with the subject. Quite a number of references to the "green flash" will be found scattered through the pages of the *Journal of the British Astronomical Association*. The following list of the places where they occur (in which the volumes of the *Journal* are denoted by Roman, the pages by Arabic, numbers) may be found useful:—vii., 514; viii., 95 and 190; x., 364; xi., 75; xii., 32, 218, 248 and 289; xiii., 382; xv., 265, 366 and 382; and xvi., 23. The observa-

tion described by Mr. Whitmell at p. 289, vol. xii. (included in the above list) is particularly interesting and will engage our attention later. Notices will also be found in *Knowledge*, April, 1889, p. 126, and in the *Monthly Notices* of the *Royal Astronomical Society*, Vol. lxi. pp. 484 and 629, besides the references to the subject which have appeared in this Magazine for January and February of this year.

I had often looked for this phenomenon, but never until last autumn had I been so fortunate as to get a view of it. When starting, as a member of the British Association, on the expedition to South Africa in July last, this was one of the many unfamiliar objects which I looked forward to seeing; but although I was generally on the look out at the time of sunset, whether the sun went down behind a sea horizon, or sank into the apparently interminable veldt, it was not until the evening of September 27th, when the sun set behind the grand range of hills terminating in Cape Guardafui, that I saw the "green flash." It was then quite unmistakable, and those who are so fortunate as to see it, as I and several of my fellow-passengers on the *Durham Castle* did on that occasion, will not, I think, retain any lingering doubts as to the objective character of the phenomenon.

On that evening I was using a good pair of field-glasses by Ross, and watched the sun's disk as it sank lower and lower behind the outline of the hills. When the visible portion of the disk was reduced to a very narrow elongated segment I could distinctly see that the tips of the segment first became green, whilst the central portion still remained a brilliant yellow or orange. As the segment became more attenuated, the green patches spread rapidly from each end, until, meeting in the middle, they merged into each other and the whole narrow segment appeared of a vivid green or bluish tint. This lasted for a very short time, the length of which I made no attempt to estimate, and then entirely disappeared.

After that date the phenomenon became one of frequent, almost daily, occurrence as we passed northwards through the Red Sea, and was observed by many of the passengers on board the *Durham Castle*. It was seen both with and without glasses, but to enable one to follow the gradual extension and meeting of the green tips some little optical aid seems necessary. The majority of the passengers, many of them well known astronomers and meteorologists, were thoroughly convinced of the objective reality of the phenomenon. Of course, as might be expected in such a large number, there were found a few sceptics. These were, for the most part, inclined to look for a physiological explanation of the phenomenon, and to attribute it to fatigue of the retina. Looking over the literature of the subject it appears to me now that the number of observations recorded of the "green flash" at *sunrise* afford a complete refutation of the physiological theory, but at the time I was not so familiar with what had been written on the subject as I have since become, and in order to test the physiological hypothesis I observed the

sunrise on several mornings in succession, and I am very glad to be able to add my testimony to that of Major Courtenay and others who have watched the sun under similar circumstances. On the morning of September 29th I was rewarded by a magnificent exhibition of the "green flash" at sunrise which appears to me to dispose absolutely of the "fatigue" argument. On that occasion I was sitting beside Prof. H. A. Miers, Professor of Mineralogy at Oxford, near the stern of the vessel, and at my request he also watched for the first appearance of the sun above the horizon. I was using my glasses, and as the east brightened I concluded, from the brilliance of the sky above one particular part of the horizon, that the sun was just about to make its appearance at that spot, and kept the glasses directed upon it. I was, however, mistaken, and, while I was thus watching, Prof. Miers exclaimed, "There it is." I instantly swept the horizon till I found the sun, losing a fraction of a second in doing so, but nevertheless, when I found it, though the segment was then rapidly widening and had already become yellow about the middle, I could yet see the long vividly green points separating rapidly and shrinking in size until the greenness entirely disappeared. I am authorised by Prof. Miers to state that the first ray as seen by him with the naked eye was of a brilliant green colour, while another distinguished scientist who was standing by preferred to describe it as blue. On October 2nd I again saw the "green flash" at sunrise.

Remarking that the "green flash" is not usually found to occur when the sun is strikingly red before setting (a clear horizon with a minimum amount of atmospheric absorption, and consequently a yellow sun, appearing to be the most favourable conditions for the occurrence of the flash), and that violet, not green, is the colour complementary to yellow, we should expect the sun*set* flash, if it were due to fatigue, to be on the violet, rather than the green, side of blue, but it is difficult to see how the eye could possibly be fatigued in such a way as to bring about the appearance of a green flash at sun*rise*.

We must, therefore, look for the explanation in another direction.

The obvious explanation, and one that seems quite sufficient to account for all the observed facts, is that the "green flash" is due to the unequal refraction experienced by rays of different colours in passing through the Earth's atmosphere. It is a well-known fact that the setting sun has actually sunk completely beneath the horizon at the moment when it appears to us to be first in contact with it, and when the upper limb is just about to disappear it is actually 36′ below the horizon. We see it in virtue of the refraction which bends the rays round the horizon so as to reach our eyes. The red being the least refrangible is the first to be lost, and the different colours of the spectrum vanish one by one in the order—red, orange, yellow, green, blue, indigo and violet.

(To be continued.)

A RECORDING ANEMOMETER FOR KITES.

By W. H. Dines, F.R.S.

In the July number of this Magazine for 1904 (Vol. **39**, p. 109), a meteorograph designed for use with kites was described. Lately an arrangement for recording the velocity of the wind has been added to it.

This is effected by registering on the sheet the tension of a length of sewing cotton, to the end of which a small light sphere of about 3 inches diameter is secured. About 40 ft. of cotton are used, so that the ball may be far from the kite and out of the way of the disturbance it causes to the air motion. The pressure upon the ball in pounds is calculated by the formula, $P = \cdot 0015\ A.\ v^2$, where A is the cross section of the ball in square feet and v the velocity of the wind in miles per hour. Since the weight of the ball acts vertically and the wind pressure horizontally, the tension of the cotton is given by the expression $\sqrt{W^2 + P^2}$, where W is the weight of the ball. The values of this for 10, 20, 30, etc., miles per hour are calculated, and weights corresponding to each value cut from a piece of lead tube. The mode of registration is shown in fig. 1. An

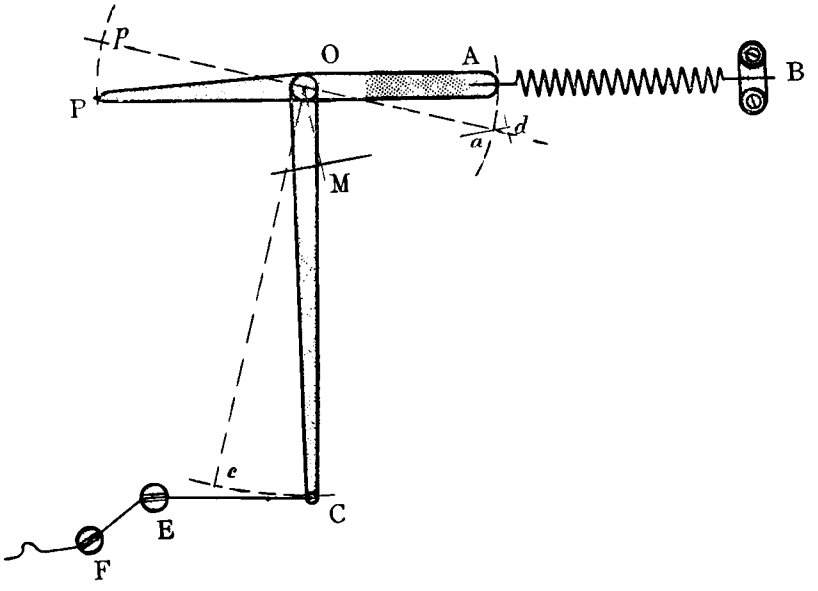

FIG. 1.—REGISTERING ARRANGEMENT OF KITE ANEMOMETER.

arm, A O P, with a pen at P, is pivoted at O, and another arm, O C, is rigidly attached to it. The cotton is tied to the point C and and passes through the two guides E and F, thence running freely through the bottom cell of the kite to the ball. A spiral spring of hard German silver wire is soldered to the arm at A and clamped in position at B. The cotton being pulled so that C comes to *c*, the

pen arm takes the position p O a, and the spring is extended through a length, d a. The force so produced is proportional to the extension, and it acts at the point M, so that the effective moment of the spring tending to draw back the pen is proportional to O M $\times$ a d; and for small deflections this is proportional to (P p)^3. There is also the force required to bend the spring into the position A d, apart from its extension, but this is of comparatively little consequence.

Toy celluloid balls weighing some 175 grains, a trifle under 3 inches diameter, are obtainable at most toy shops. With such a ball, the weights for 0, 10, 20, etc., miles per hour are about 175, 184, 268, 486, 820, 1260, 1810 grains. These balls give a reliable scale for values over 20 miles per hour. They are far stronger than is required and it should be possible to get much lighter ones specially made. With half the weight, the record would be reliable to 15 miles, which would suffice for work with kites.

The velocities are calculated for an air pressure of 30 inches of mercury, and an allowance must be made for decrease of density. This may be done approximately up to 10,000 feet by adding $1\frac{1}{2}$ per cent. to the velocity for each 1000 feet of vertical height.

The scale is obtained by hanging the weights previously mentioned to the end of the lever and marking the corresponding position of the pen. It has been found that the velocities thus recorded, or rather thus deciphered, have been in close agreement with the velocities obtained by cloud observations, whenever the latter have been available.

The upper wind is much steadier than that near the surface, and very little difficulty has been experienced from the oscillation of the pen. To check the oscillation the two guides, E and F, are placed so that F E C is not a straight line, and the departure from straight-

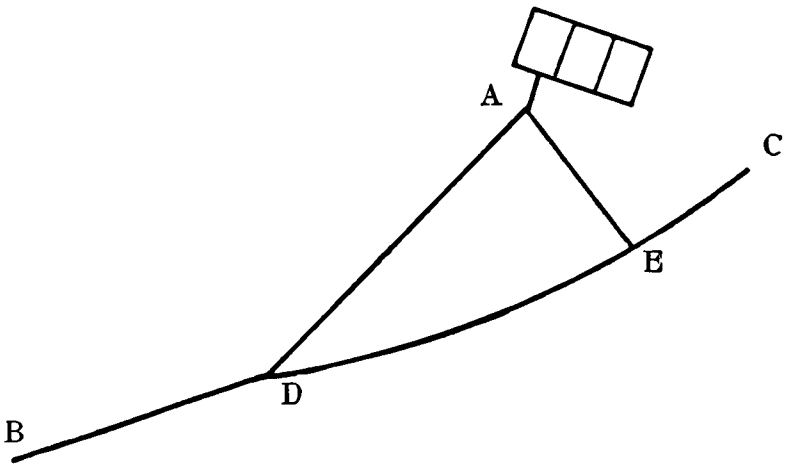

FIG. 2.—METHOD OF ATTACHING SUPPLEMENTARY KITE.

ness is easily arranged so that the friction of the cotton on the guides may check the oscillations, but yet allow every variation of the wind to be followed by the pen. Fresh cotton is used for each ascent, and no trouble has been found in starting the kite with the ball trailing out behind.

A plan of attaching a supplementary kite to the line, which avoids all risk of fouling, has been adopted with good results. The supplementary kite A (fig. 2) is attached to the line B C by 30 feet of strong cord tied to a clamp at D. A second clamp is placed at E, so that D E = 30 feet, and A and E are kept apart by a light bamboo some 10 feet long. D A and D E are not necessarily 30 feet, but must be of nearly equal length, and 30 feet is the length that has been used. Of course the bamboo is an objection in that it offers some resistance to the wind, but the resistance is not great. There always used to be anxiety with a second kite lest the wind should temporarily fail and allow the kite to drop on to or under the main wire and foul it, but with the present arrangement this cannot occur, since the bamboo in such a case pushes the wire out of the way.

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting was held on Wednesday evening, February 21st, at the Society's Rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. E. Mawley read his "Report on the Phenological Observations for 1905." He said that as affecting vegetation the weather of the phenological year ending November, 1905, was chiefly remarkable for the dryness and mildness of the winter months, the drought and frosts in May, the long spell of hot and dry weather in July, and an exceptionally cold period in October. Wild plants came into flower a few days earlier than usual until about the beginning of May, after which time they were as a rule late to about the same extent. Most of the early spring migrants, such as the swallow and nightingale, reached these shores in advance of their average dates. The best farm crops of the year were those of wheat, beans and hops, while barley, potatoes, turnips and mangolds were all more or less over average. On the other hand, the yield of oats, peas and hay was almost everywhere deficient—the last being the worst crop of the year. Apples, pears and plums were below average in all parts of the British Isles, whereas the small fruits as a rule yielded well. Taking the farm crops alone, the past year must be regarded as having been on the whole a fairly bountiful one.

Mr. F. C. Bayard referred to the destruction of bud and blossom by wild birds.

Mr. J. E. Clark stated that he had noticed that, besides the apple crop being poor, the fruit was keeping badly. This was especially marked in Somerset, the county of the apple. He also said that, in

spite of the severe frost of last October, at Christmas time there were found in the Croydon district thirty-three species of wild plants in bloom as compared with only seven in the previous year, and of garden varieties fifteen were seen as against seven at Christmas, 1904.

Mr. C. Harding said that Mr. Mawley had now worked up the phenological observations for so long a period that he hoped he would soon forecast the seasons and say whether we were likely to have good or bad crops.

Mr. H. Southall, Mr. J. Hopkinson, Mr. F. Druce, Mr. D. W. Horner, and Mr. N. ffarington, also took part in the discussion.

Mr. Mawley, in reply, said that no doubt the reason why the apples were keeping so badly was that the dull and cold autumn had prevented the fruit from ripening sufficiently.

The President endorsed what had been said about the destruction of buds and blossoms by small birds, as in his neighbourhood in Buckinghamshire they had wrought considerable damage, especially the bullfinches and sparrows. He thought it would be of immense value if accurate forecasts of frosts in the spring months could be established in this country. He had note of one such forecast in California, which, by the farmers taking the necessary precautions, had been the means of saving thousands of dollars.

The other papers read were :—"Brief Discussion of the General Features of the Pressure and Wind Conditions over the Trades-Monsoon Area," by Mr. W. L. Dallas; and "The Dispersal or Prevention of Fog," by Dr. W. B. Newton.

The following gentlemen were elected Fellows of the Society :—Mr. C. A. Cheyne, Mr. O. Fulton, Lieut.-Col. G. M. J. Giles, Mr. A. J. V. Rapkin, Mr. W. H. Taylor, and Mr. J. W. White.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

HYDROTHERMODYNAMIC THEORY.

I AM grateful for the short analysis of the *Théorie hydrothermodynamique des tourbillons atmosphériques*, which appeared in the last number of the Magazine, but permit me to correct a statement that may lead to a misunderstanding of the constitution of atmospheric whirls according to this theory.

All of us know well the distinct and separate existence of the cyclone and the anticyclone. The analysis referred to attributes to me the assumption that "the cyclone and the anticyclone are parts of one whole, one being always superimposed upon the other and separated by a stratum of air at an elevation of from 18,000 to 21,000 feet." This is too concise to be intelligible.

There are two distinct whirls at the surface of the Earth—one converging, the cyclone, the other diverging, the anticyclone. But both are double in height, and the two superimposed whirls are always symmetrically disposed by their vertical constitutive currents; thus, the superior cyclone is descending as an inferior anticyclone, and the superior anticyclone is ascending as an inferior cyclone.

The existence of these two superimposed and symmetrical whirls is a natural, physical and logical consequence of the fact that the primary cause of the trouble in the air and of the low pressure in the cyclone and of the high pressure in the anticyclone, is to be searched for in the middle region, not at the surface of the Earth. For if that trouble engenders in the subjacent and depressed masses a gyratory motion with ascending current, it necessarily engenders in the superjacent ones a similar gyration with descending current. On the other side, if the masses of air abstracted out of the cyclone in that middle region accumulate finally, as they do, in another part of the same stratum, the resulting overpressure makes the subjacent masses to descend and the superjacent to ascend.

Now the descending whirl upon the cyclone is not a true anticyclone, and the ascending one upon the anticyclone is not a true cyclone, because the first is a column of low pressure continuing the inferior cyclone, and the second a column of high pressure continuing the inferior anticyclone.

This last assumption is the more important as one seems to have groundlessly contradicted or not exactly studied it. I think I have put it in full light in the *Théorie hydrodynamique*, and recently in the Bulletin of the Jersey Observatory for 1905, in a note *Sur la Pression et la Temperature dans les Cyclones et dans les Anticylones: réponse à M. J. Hann.*

MARC DECHEVRENS, S.J.

Observatoire St. Louis, Jersey, 18th February, 1906.

LOCALIZATION OF SNOW ON THE SURREY HILLS, ON FEBRUARY 24th, 1906.

THE distribution of snow-covered ground was very peculiar in the neighbourhood of Dorking on February 24th, showing a relationship, real or apparent, with the geological character of the district.

The chalk of Box Hill and of the North Downs generally to the north of the town was, so far as I could see, completely destitute of snow, the sandy tract of Ranmore Common to the north-west was snow-clad in patches, whilst the sandstone uplands of Leith Hill, together with the adjacent meadows below to the south-west, were covered to a depth varying from two to three inches, and the bare boughs of rugged oaks in meadow and woodland were decked with snow in a beautiful manner. Either the snow-fall which was experienced very generally in the counties south of the Thames in the

early morning of the 23rd had been much heavier towards the south-west of Dorking than towards the north-east, or else a rapid thaw had set in on the chalk hills in the latter direction. Unfortunately, I was quite unprepared to find much snow in Surrey on the date in question, so that within the limits of a few hours I was unable to make such detailed and accurate observations upon the distribution of the covering of snow in relation to the nature of the subjacent rocks as I should otherwise have made; but perhaps readers who may happen to reside in the Dorking district or anywhere along the strip of the upper greensand formation beneath the chalk escarpment, say from Guildford to Sevenoaks, could add to the above remarks concerning the distribution of snow-covered ground on the 23rd and 24th. I do not know whether the subject of the influence which different species of rock in virtue of their different physical constants may exert upon the permanence of a superincumbent layer of snow has yet been submitted to mathematical investigation. In the present connection a comparison, could it have been made, of the temperature before the snow-fall, on and below the surface of the chalk and sandstone of Box Hill and Leith Hill respectively would probably have yielded interesting results, as also would a comparison of the state of the rocks with respect to saturation.

L. C. W. BONACINA.

Hampstead, N. W., Feb. 25th, 1906.

[Was the snow absent from the northern slopes of the North Downs, and was it present on the southern slopes of Leith Hill? In other words, was the distribution not due to exposure to the sun rather than to conduction from the rock?—ED. *S.M.M.*]

THE GREEN FLASH.

EXCUSE my observing that Major Courtenay does not say that he saw the green flash before the sun rose above the horizon.

As soon as the whole or a portion of the sun's disc becomes visible at sunrise, the eye will be impressed by the colour of the disc, and exhibit its vital elasticity by producing out of itself the demanded colour, which, if the sun is red, will be green.

Even while the sun is still below the horizon, it is announced by a red light, which colours the atmosphere and tinges the clouds in the neighbourhood. This red light is sufficient to stimulate the retina to produce the opposite colour.

R. C. CANN-LIPPINCOTT.

Over Court, Almondsbury, Bristol, 20th Feb., 1906.

[We hope next month to publish the conclusion of Dr. Rambaut's article on the Green Flash, and subsequently to summarize the interesting correspondence which Admiral Maclear's recent letter has called forth.—ED. *S.M.M.*]

HIGH TEMPERATURES IN MARCH.

PERHAPS the following abnormally high maximum readings for the season may be of interest. Equally high temperatures were last recorded here in the first week of September. On 6th and 7th inst. there was also heavy dew by 9.0 p.m.

The instruments are Kew verified.

	Max. in Screen.	Solar Radiation (b. b. in v.)
March 6	64°0	105°3
,, 7	65°6	107°5

W. J. CARTER.

Montem Road, New Malden, Surrey, 9th March, 1906.

SYDNEY CLIMATOLOGICAL NORMALS.

WE have been favoured with a copy of the summarized climatological observations taken at the Government Observatory at Sydney, New South Wales, during the 46 years 1859 to 1904, containing the averages of the usual meteorological elements and the extreme values noted during that period. Of these averages the most important are quoted in the following table:—

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	YEAR
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Barometer (cor. Aver. Mean Max.	29·929	29·973	30·054	30·103	30·091	30·036	30·115	30·103	30·045	30·001	29·981	29·918	30·029
Shade Temp.	78°2	77°2	75°4	70°8	64°8	60°4	58°9	62°2	66°3	71°0	74°2	77°1	69°7
,, Mean Min. Shade Temp.	64·8	64·8	63·1	58·2	52·0	48·2	45·7	47·5	51·4	55·9	59·6	62·8	56·2
,, Temp. of Sea...	71·4	71·8	70·9	68·3	64·2	59·9	57·3	57·5	60·3	63·3	66·7	69·4	65·1
,, Wind Movement...	mi. 8010	mi. 6447	mi. 6473	mi. 5896	mi. 6046	mi. 6893	mi. 6978	mi. 6678	mi. 6844	mi. 7284	mi. 7426	mi. 7629	mi. 6884
,, Rainfall ..	in. 3·57	in. 4·88	in. 5·10	in. 5·65	in. 5·24	in. 5·51	in. 4·77	in. 3·24	in. 2·97	in. 2·98	in. 3·10	in. 2·50	in. 49·51
,, No. of Rainy Days	14	14	15	13	16	13	12	12	12	13	13	13	160
,, Evaporatn.	in. 5·30	in. 4·22	in. 3·60	in. 2·49	in. 1·58	in. 1·26	in. 1·20	in. 1·50	in. 2·50	in. 3·81	in. 4·68	in. 5·28	in. 37·42

Among the more interesting extremes it may be noted that the maximum shade temperature exceeded 100° in each of the five months November to March, reaching the highest point on January 13th, 1896, when 108°5 was registered. In no month of the year did the maximum fail to reach 70°, the lowest extreme being 74°7 in June The lowest minima recorded varied from 51°2 in January to 35°9 in July, the mid-winter month, showing that frost in the screen has been unknown in Sydney during the last half-century. The thermometer exposed to terrestrial radiation, however, fell below freezing point on some occasion during each month from May

to September inclusive, the absolute minimum being as low as 24°·0 on July 4th, 1893. Unfortunately details as to the number of ground frosts recorded are omitted, although their occurrence, even at rare intervals, must form an important feature in a sub-tropical climate.

Turning to the extremes of relative humidity it is instructive to remark that on no day in the whole period did this exceed 90 per cent. at 9 a.m., and from September to June never reached 80 per cent, a marked contrast to the climate of London, where complete saturation of the atmosphere is of comparatively frequent occurrence. On the other hand, the amount of moisture never fell so low as in the arid districts of the interior of Australia, the minimum at 9 a.m. being above 60 per cent. in eight months of the year, and never less than 55 per cent.

Some of the most remarkable of the figures quoted are undoubtedly the extremes of rainfall. Although the annual total is on the average less than 50 inches and the number of rainy days as many as 160,* eight months of the year, chiefly in autumn and winter, show daily maxima exceeding 5·00 in. February, April and May had each falls of more than 7·00 in. in 24 hours, the greatest being 8·90 in. on February 25th, 1873.

The monthly means fall into a well-marked seasonal curve, reaching a maximum in April, corresponding to the October maximum of the north temperate zone, and a relatively dry season during the second half of the year, or spring and early summer. Every month, except December, is liable to a fall of 10 inches and April and May have exceeded 20 inches. The driest months in each instance had less than ·50 in., but there was no absolutely rainless month.

No information is given as to the instruments employed in arriving at the average amounts of evaporation, but if these can be relied upon, considerably more than two-thirds of the annual rainfall is returned to the atmosphere in this direct manner.

THE CYCLONIC DISTRIBUTION OF RAINFALL,

MR. J. A. UDDEN has published a paper† bearing on the methods of studying the distribution of weather conditions in cyclones, a full abstract of which may prove interesting. The work was suggested by a lecture delivered by a "Weather Bureau man," who "especially emphasized a statement we often find in text-books, that the greatest precipitation occurs in the region which lies some distance to the

* It may be noted that the number of rainy days is the same as in London, while the amount of rainfall is twice as great, so that the average fall of rain per day in Sydney is twice as great as in London.

† "On the Cyclonic Distribution of Rainfall." By Johan August Udden. Published by Authority of the Board of Directors of Augustana College and Theological Seminary, Rock Island, Ill. 1905. Size 10¼ × 8. Pp. 22.

south-east of an area of low pressure," and by the remark of an observer of the weather at Davenport, Ill., who observed that the Weather Bureau forecasts usually came true, but that the predicted storms were apt to be a little behind time. Mr. Udden thought that there might be some connection between the two statements and resolved to determine by some statistical method the actual relation of weather conditions to different parts of a cyclone for his locality.

He accordingly made a diagram, reproduced in fig. 1, which represented a circular cyclone 2000 miles in diameter. The inner circle

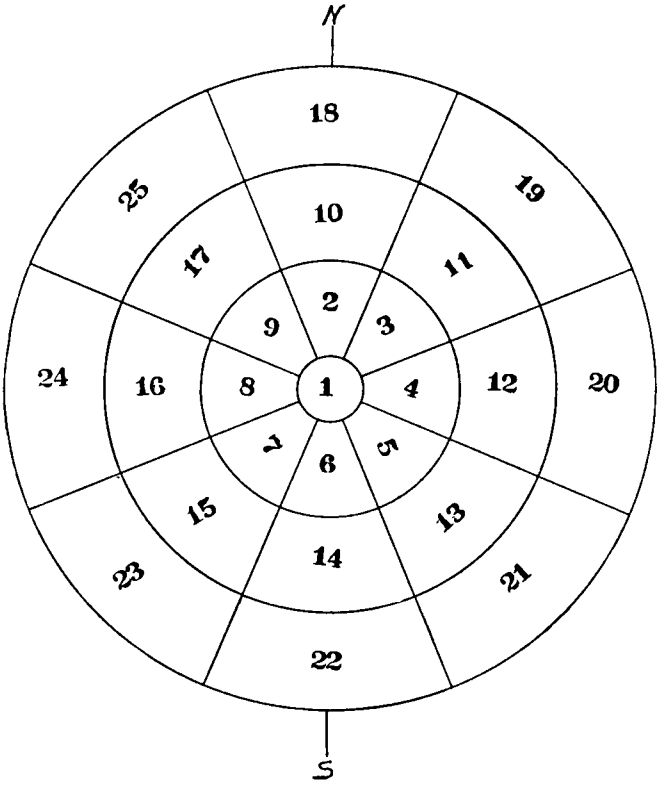

Fig. 1.

has a radius representing 100 miles, and the succeeding circles have radii each 300 miles longer than the one before. The circles are divided by eight radii and the resulting compartments numbered from 1 to 25, as shown. His method was then simply to take a sufficient number of observations of the weather at Davenport when that station lay in any one of the 25 corresponding tracts of an actual cyclone and to average these for each tract separately and thus obtain for each separate percentages expressing frequency of certain

weather conditions—precipitation, cloudiness and resultant wind direction being the three to which special attention was directed.

The observations at Davenport were made at 8 a.m. during about five years, the data being taken from the daily weather maps. About 1000 observations resulted, distributed somewhat unequally throughout the 25 tracts, but enough to secure a fairly representative average. "In other words: the number of times precipitation occurred or cloudiness prevailed was noted when Davenport was located in any one of the designated tracts with reference to the centre of a low area, and also the total number of times the opposite conditions prevailed. From these two figures percentages were obtained showing the comparative frequency of precipitation or cloudiness in each tract."

The result of this study was to show that at Davenport precipitation is most frequent when the station lies in tract No. 8, and relatively least frequent in the tracts to the south-east of the centre. Hence Mr. Udden points out that if precipitation is predicted on the assumption that the maximum frequency lies to the south-east of the centre a considerable number of hours will usually elapse before the wettest part of the cyclone, lying west of the centre, passes over

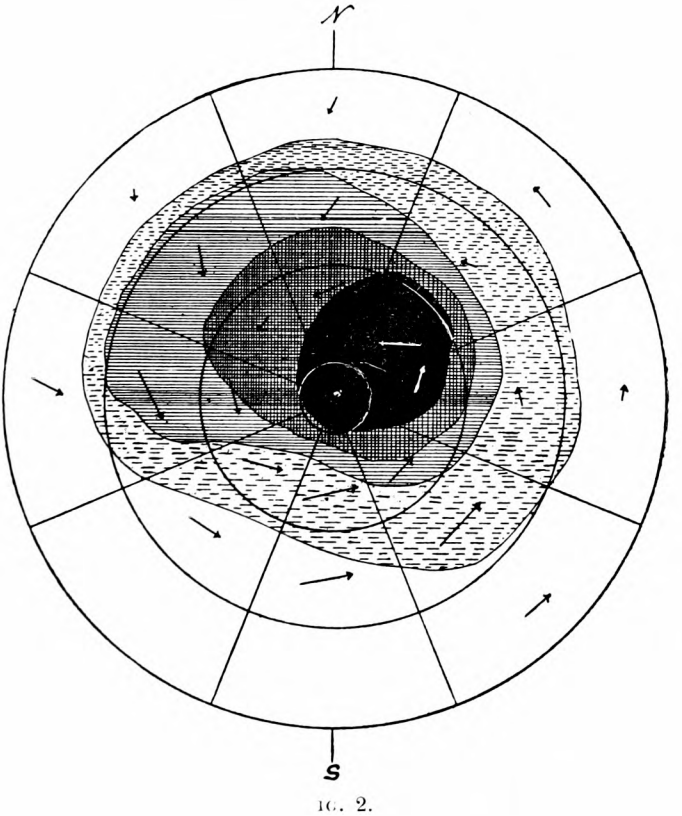

FIG. 2.

the place and thus the postponement of the prediction is accounted for.

Enlisting the aid of his students, Mr. Udden proceeded to make similar studies of other localities, representative of four different climatic regions of the United States, but in these he combined results from different stations—viz., Amarillo, Dodge City, Wichita, and Oklahoma, during 1894—98, to represent the south-western plains; Helena, Miles City, Leander and Boise City, for 1899; nine stations in the Upper Missouri Valley, for 1899; and finally Detroit and Buffalo for the years 1900—1903. The result was to "show clearly that the area of the greatest rain and snowfall is not in the same position with regard to the centres of low areas in different climatic regions. In every case it is eccentric and lies to the west, north-west, north or north-east, in the cases studied, but in no instance to the south-east." We reproduce in fig. 2 the diagram of the distribution of precipitation and wind direction in a composite cyclone, based on the 8 a.m. observations at Detroit and Buffalo, where the heaviest precipitation lay in tract 3.

Mr. Udden indicates several lines of future research suggested by his first results, although the purpose of his paper was merely to call attention to the method of averaging. He suggests that diagrams for different hours of the day might show different results, that summer and winter cyclones are unlike, "and it is believed that there are differences among the cyclones coming along different paths."

The above is a full abstract of the paper before us. Several points are left obscure. We are not told what limits of intensity were adopted in the estimation of the frequency of precipitation or cloud, nor is it stated whether only cyclones which preserved the cyclonic form of isobars for 1000 miles from the centre were included, or whether smaller cyclones merging into anticyclonic areas were also taken into account. The last suggestion quoted above as to differences in the direction of the path producing different effects is probably of high importance. The study of the distribution of rain in individual cyclones, by Dr. H. R. Mill,* has shown that in the majority of rain-bringing cyclones which cross the British Isles, by far the greatest amount of precipitation occurs on the left of the track in whatever direction the cyclone is moving; and this suggests that it might be expedient to number the tracts in Mr. Udden's plan, not with relation to the cardinal points, but rather with reference to the diameter which lies in the line of the track of the centre.

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* "On the Unsymmetrical Distribution of Rainfall about the path of a Barometric Depression," *Symons's Meteorological Magazine*, **39** (1904), 161–165, and in *Report* of Eighth International Geographic Congress, 1904. Washington, 1905 Pp. 393—396.

REVIEWS.

Lehrbuch der Meteorologie von DR. JULIUS HANN. *Zweite, neubearbeitete Auflage.* Leipzig: 1906, C. H. Tauchnitz. Size $10\frac{1}{2} \times 7\frac{1}{2}$, Pp. xii. + 644. Plates. Price 24 Marks.

PROFESSOR HANN'S hunger for hard work has urged him to prepare a new and completely revised edition of his great text book of Meteorology, in which he brings the volume to date and improves it in every part. Much has been done by meteorologists in the five years which separate the second edition from the first, and the greatest tribute to the author's genius which any critic can offer is to point out that while nothing of real importance has been omitted, the new edition is 160 pages shorter than the old. This is brought about by a reduction of the very voluminous references to the older literature of the subject given in the first edition, and by a general compression of the subject matter, which was not possible when the book was being assembled out of the scattered constituent parts. We may look on the new *Lehrbuch* as the completed scheme towards which the author was working, freed from the scaffolding naturally required in putting the facts together for the first time.

Special attention is given to the results obtained by the investigations of the upper atmosphere, which form so important a feature of recent meteorological work. Amongst the additions and improvements we may also note a table of the mean monthly and annual temperatures at 143 places in all parts of the Earth, a shorter table of mean monthly and yearly rainfall at selected places, together with hygrometric and barometric tables. We have noticed several trifling typographical errors which have escaped mention in the table of errata, but most of these are of a kind which should have been put right by the printer's reader and do not reflect on the keenness of the author or his scrupulous exactitude in matters of scientific fact.

The Meteorology of the Ben Nevis Observatories. Part III., containing the Observations for the years 1893, 1894, 1895, 1896 and 1897, with Appendix. Edited by ALEXANDER BUCHAN, LL.D., F.R.S., and ROBERT TRAILL OMOND. *Forming Volume XLIII. of the Transactions of the Royal Society of Edinburgh.* Edinburgh: 1905. Size $12 \times 9\frac{1}{2}$. Pp. 566.

THIS substantial volume contains the hourly readings of the meteorological instruments at the summit and low-level Ben Nevis Observatories for the five years 1893—97. In addition to the Tables, which occupy some 500 pages, there are two memoirs: the first, by Dr. Buchan, on the interrelation of barometric pressure, temperature, humidity, rainfall, cloud, sunshine, and wind, illustrated by the observations made at the two Observatories; and the second, by Dr. A. J. Herbertson, a report on hygrometric researches mainly at the Ben Nevis Observatories.

TEMPERATURE FOR FEBRUARY, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [or E.]	Height above Sea.	TEMPERATURE. Max.		TEMPERATURE. Min.		No. of Nights at or below 32	
									Shade.	Grass.
		° ′	° ′	ft.	°	Date.	°	Date.		
Camden Square	*London*	51 32	0 8	111	51·1	24	26·1	22	14	21
Tenterden	*Kent*	51 4	*0 41	190	50·5	16	27·0	22	11	17
Hartley Wintney	*Hampshire*	51 18	0 53	222	49·0	25	23·0	6, 22	17	21
Hitchin	*Hertfordshire*	51 57	0 17	238	47·0	10	25·0	5	19	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	49·0	25	19·0	6	17	25
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	51·0	25	26·0	9	...	...
Brundall	*Norfolk*	52 37	*1 26	66	.	...	...	...	...	...
Alderbury	*Wiltshire*	51 2	1 44	263	50·0	1, 21	20·0	5	18	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	48·8	26	20·0	6	13	18
Torquay (Cary Green)	*Devon*	50 28	3 32	12	51·5	20	29·6	6	3	22
Polapit Tamar [Launceston]	,,	50 40	4 22	315	49·4	16	25·6	6	9	13
Bath	*Somerset*	51 23	2 21	67	50·5	10	22·0	6	14	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	48·0	1, 26	25·0	5	15	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	48·0	23	24·0	9 ‡	25	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	45·0	25	21·0	5	21	...
Boston	*Lincolnshire*	52 58	0 1	25	45·0	10	25·0	6	17	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	51·6	26	24·5	6	19	26
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	49·0	26	22·0	6	18	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	47·6	7	27·1	5	14	26
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	48·0	1	26·0	18	18	26
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	45·1	9	24·0	5	15	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	49·0	8	26·4	18	11	20
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	50·0	8 †	21·0	4	15	...
Llandudno	*Carnarvon*	53 20	3 50	72	49·2	25	31·0	18	2	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	47·0	1, 6, 7	22·0	25	17	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	47·0	19	22·0	4, 12	23	27
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	48·3	1	25·3	9	17	22
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	47·0	21, 22	21·0	4	12	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	46·0	1	20·0	11	20	27
Tighnabruaich	*Argyll*	55 55	5 14	50	42·0	1	24·0	23	24	26
Mull (Quinish)	,,	56 36	6 13	35	45·0	1	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	47·3	6	23·4	5	20	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	48·0	1	20·0	9	26	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	47·0	18	24·0	9	22	...
Castletown	*Caithness*	58 35	3 23	100	46·0	21	17·0	10	21	25
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	52·5	21	30·0	18	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	50·0	2, 26	24·0	5, 14	15	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	44·0	var.	23·0	10, 11	13	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	50·1	1	29·1	12	9	20
Ballinasloe	*Galway*	53 20	8 15	160	53·2	18, 24	21·0	21	20	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	..
Seaforde	*Down*	54 19	5 50	180	47·0	1, 9	27·0	var.	19	23
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	46·0	1, 7, 28	27·0	13, 20	17	24

† and 16, 25. ‡ and 10, 11, 12

RAINFALL FOR FEBRUARY, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 70-99. in.	1906. in.	Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Max. in 24 hours. Date.	No. of Days	Aver. 1870-99. in.	1906. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1870-1899. in.	STATION.
1·62	1·89	+ ·27	117	·37	17	21	3·51	5·91	+2·40	168	25·16	Camden Square
1·85	2·22	+ ·37	120	·38	17	17	4·21	5·86	+1·65	139	28·36	Tenterden
2·06	1·95	— ·11	95	·43	17	20	4·45	6·29	+1·84	141	27·10	Hartley Wintney
1·54	1·63	+ ·09	106	·31	16	18	3·35	5·17	+1·82	154	24·66	Hitchin
1·73	1·85	+ ·12	107	·25	16	19	3·78	5·52	+1·74	146	26·75	Addington
1·55	2·39	+ ·84	154	·43	19	21	3·25	6·03	+2·78	185	25·39	Westley
1·49	2·58	+1·09	173	·45	16	21	3·16	6·52	+3·36	206	25·40	Brundall
2·21	2·78	+ ·57	126	·40	16, 22	17	4·88	8·43	+3·55	173	29·17	Alderbury
3·11	4·18	+1·07	134	·75	22	22	7·01	13·09	+6·08	187	39·00	Winterbourne Stpltn
2·87	3·81	+ ·94	133	·90	22	19	6·06	10·02	+3·96	165	35·00	Torquay
2·84	5·34	+2·50	188	·78	16	25	6·71	12·80	+6·09	191	38·85	Polapit Tamar
2·12	2·09	— ·03	99	·57	22	20	4·64	6·35	+1·71	137	30·75	Bath
2·13	1·81	— ·32	85	·24	16	18	4·59	6·52	+1·93	142	29·85	Stroud
2·27	2·65	+ ·38	117	·35	8	18	5·08	6·81	+1·73	134	33·04	Woolstaston
1·63	1·51	— ·12	93	·30	8	12	3·54	5·05	+1·51	143	24·50	Bromsgrove
1·55	2·46	+ ·91	159	·45	27	14	3·14	4·90	+1·76	156	23·30	Boston
1·58	1·96	+ ·38	124	1·00	27	19	3·32	4·87	+1·55	147	24·70	Hodsock Priory
1·66	2·57	+ ·91	155	·82	27	20	3·61	5·85	+2·24	162	26·18	Derby
2·67	4·52	+1·85	169	·63	10	22	6·05	10·99	+4·94	182	42·43	Bolton
1·63	2·05	+ ·42	126	·45	27	20	3·52	6·00	+2·48	171	26·96	Ribston Hall
4·74	5·69	+ ·95	120	·79	10	18	11·07	15·65	+4·58	141	60·96	Arncliffe Vic.
1·86	1·71	— ·15	92	·52	27	16	3·66	4·21	+ ·55	115	27·02	Hull
1·58	1·05	— ·53	66	·38	19	16	3·54	3·47	— ·07	98	27·99	Newcastle
1·64	9·34	—2·30	80	1·61	9	16	26·35	29·27	+2·92	111	132·68	Seathwaite
3·13	4·12	+ ·99	132	·66	16	24	6·98	11·69	+4·71	167	42·81	Cardiff
3·70	4·06	+ ·36	110	·71	22	22	8·83	11·40	+2·57	129	47·88	Haverfordwest
3·03	4·14	+1·11	137	·50	9	22	6·90	11·39	+4·49	165	45·41	Gogerddan
1·97	2·94	+ ·97	149	·47	9	18	4·54	6·82	+2·28	150	30·98	Llandudno
3·62	2·53	—1·09	70	·50	15	11	8·16	7·37	— ·79	90	43·43	Cargen
2·41	1·44	— ·97	60	·30	25	14	5·01	4·42	— ·59	88	33·04	Riddell House
...	1·01	...	...	·26	19	12	...	4·12	...	...	....	Edinburgh
3·67	2·83	— ·84	77	·44	24	17	8·19	7·73	— ·46	94	44·85	Colmonell
2·53	2·84	+ ·31	112	·48	24	18	5·78	7·61	+1·83	132	35·80	Glasgow
4·57	6·19	+1·62	135	·69	16	19	10·43	13·39	+2·96	128	57·90	Tighnabruaich
4·50	4·65	+ ·15	103	·85	24	21	10·35	11·46	+1·11	111	57·53	Quinish
2·10	·70	—1·40	33	·25	24	13	4·20	2·75	—1·45	66	28·95	Dundee
2·70	2·87	+ ·17	106	...	...	...	5·61	6·50	+ ·89	116	36·07	Braemar
2·43	2·52	+ ·09	104	·55	24	20	4·75	4·09	— ·66	86	33·01	Aberdeen
1·86	2·18	+ ·32	117	·45	8	16	4·00	4·94	+ ·94	124	29·37	Cawdor
4·89	2·22	—2·67	46	·41	25	8	11·52	14·95	+3·43	130	56·00	Invergarry
5·77	6·50	— ·27	96	·88	25	25	15·52	21·20	+5·68	137	86·50	Bendamph
2·39	5·81	+3·42	243	1·62	25	16	5·01	8·68	+3·67	173	31·60	Dunrobin Castle
...	6·49	...	...	1·84	10	25	...	9·24	...	...	...	Castletown
5·44	4·64	— ·80	85	·61	12	27	12·01	11.00	—1·01	92	58·11	Killarney
3·30	3·69	+ ·39	112	1·48	22	17	7·36	8·55	+1·19	116	39·30	Waterford
2·19	2·87	+ ·68	131	·38	12	25	5·17	8·23	+3·06	159	33·47	Hurdlestown
2·61	2·62	+ ·01	100	·61	18	19	5·76	6·48	+ ·72	113	34·44	Carlow
1·98	1·64	— ·34	83	·38	22	20	4·14	5·77	+1·63	139	27·75	Dublin
2·48	3·04	+ ·56	123	·63	9	24	5·97	8·74	+2·77	146	37·04	Ballinasloe
6·08	6·05	— ·03	100	·75	9, 24	23	13·94	17·13	+3·19	123	80·23	Kylemore House
4·01	4·84	+ ·83	121	·52	15	25	9·01	11·92	+2·91	132	50·50	Enniscoe
2·97	2·05	— ·92	69	·39	19	19	6·60	6·02	— ·58	91	38·61	Seaforde
2·73	3·94	+1·21	144	·48	2	27	6·29	9·71	+3·42	154	41·20	Londonderry
2·49	3·00	+ ·51	120	·40	2	20	5·83	8·34	+2·51	143	37·85	Omagh

SUPPLEMENTARY RAINFALL, FEBRUARY, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	2·39	XI.	Rhayader, Tyrmynydd	7·00
,,	Ramsgate, West Cliff Villas	1·57	,,	Lake Vyrnwy	6·51
,,	Hailsham	3·06	,,	Llangyhanfal, Plâs Draw	2·53
,,	Crowborough, Uckfield Lodge	3·26	,,	Criccieth, Talarvor	4·10
,,	Osborne, Newbarn Cottage.	3·66	,,	Llanberis, Pen-y-pass	14·28
,,	Emsworth, Redlands	3·10	,,	Lligwy	3·36
,,	Alton, Ashdell	3·11	,,	Douglas, Woodville	3·75
,,	Newbury, Welford Park	2·55	XII.	Stoneykirk, Ardwell House	1·56
III.	Harrow Weald, Hill House.	2·10	,,	Dalry, The Old Garroch	4·97
,,	Oxford, Magdalen College	1·35	,,	Langholm, Drove Road	3·84
,,	Bloxham Grove	1·81	,,	Moniaive, Maxwelton House	3·47
,,	Pitsford, Sedgebrook	2·22	XIII.	N. Esk Reservoir [Penicuick]	2·35
,,	Huntingdon, Brampton	1·71	XIV.	Maybole, Knockdon Farm	2·56
,,	Wisbech, Bank House	1·98	,,	Campbeltown, Witchburn	3·94
IV.	Southend Water Works	1·42	XV.	Inveraray, Newtown	5·70
,,	Colchester, Lexden	1·93	,,	Ballachulish House	6·52
,,	Newport, The Vicarage	2·10	,,	Islay, Eallabus	5·65
,,	Rendlesham	1·96	XVI.	Dollar Academy	2·76
,,	Swaffham	2·35	,,	Loch Leven Sluice	2·11
,,	Blakeney	1·91	,,	Balquhidder, Stronvar	4·03
V.	Bishops Cannings	2·75	,,	Perth, Pitcullen House	1·44
,,	Ashburton, Druid House	5·38	,,	Coupar Angus Station	1·24
,,	Okehampton, Oaklands	5·43	,,	Blair Atholl	3·31
,,	Hartland Abbey	4·71	,,	Montrose, Sunnyside Asylum	1·12
,,	Lynmouth, Rock House	4·48	XVII.	Alford, Lynturk Manse	2·31
,,	Probus, Lamellyn	5·44	,,	Keith Station	2·41
,,	Wellington, The Avenue	2·82	XVIII.	N. Uist, Lochmaddy	3·56
,,	North Cadbury Rectory	2·70	,,	Alvey Manse	1·92
VI.	Clifton, Pembroke Road	2·53	,,	Loch Ness, Drumnadrochit.	3·42
,,	Moreton-in-Marsh, Longboro'	2·25	,,	Glencarron Lodge	6·36
,,	Ross, The Graig	1·23	,,	Fearn, Lower Pitkerrie	2·57
,,	Shifnal, Hatton Grange	1·46	XIX.	Invershin	4·09
,,	Cheadle, The Heath House.	3·10	,,	Altnaharra	6·42
,,	Coventry, Kingswood	2·64	,,	Bettyhill	5·39
VII.	Market Overton	1·80	,,	Watten Station	4·17
,,	Market Rasen	2·25	XX.	Dunmanway, The Rectory	5·28
,,	Bawtry, Hesley Hall	2·01	,,	Cork	2·85
VIII.	Neston, Hinderton	1·98	,,	Darrynane Abbey	4·75
,,	Southport, Hesketh Park	3·26	,,	Glenam [Clonmel]	3·41
,,	Chatburn, Middlewood	3·22	,,	Ballingarry, Gurteen	2·54
,,	Cartmel, Flookburgh	2·78	,,	Miltown Malbay	4·21
IX.	Langsett Moor, Up. Midhope	4·27	XXI.	Gorey, Courtown House	2·58
,,	Scarborough, Scalby	2·04	,,	Moynalty, Westland	2·81
,,	Ingleby Greenhow	2·18	,,	Athlone, Twyford	2·84
,,	Mickleton	1·34	,,	Mullingar, Belvedere	2·91
X.	Bardon Mill, Beltingham	1·30	XXII.	Woodlawn	3·85
,,	Ewesley, Fallowlees	1·19	,,	Westport, Murrisk Abbey	4·49
,,	Ilderton, Lilburn Cottage	·95	,,	Collooney, Markree Obsy	4·20
,,	Keswick, York Bank	4·10	XXIII.	Enniskillen, Portora	3·13
XI.	Llanfrechfa Grange	3·90	,,	Warrenpoint, Summer Hill.	2·21
,,	Treherbert, Tyn-y-waun	7·29	,,	Banbridge, Milltown	2·42
,,	Carmarthen, The Friary	4·56	,,	Belfast, Springfield	3·29
,,	Castle Malgwyn [Llechryd].	4·20	,,	Bushmills, Dundarave	2·62
,,	Plynlimon	10·08	,,	Stewartstown, The Square	2·78
,,	Tall-y-llyn	3·10	,,	Killybegs	6·21
,,	New Radnor, Ednol	3·86	,,	Horn Head	4·31

METEOROLOGICAL NOTES ON FEBRUARY, 1906.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

London, Camden Square.—Rainy and unpleasant conditions continued with little intermission until about 19th, but with considerably reduced temp.; the last week was, however, somewhat more genial. Mean temp. 38°·7, or 1°·1 below the average and 3°·2 below the mean for January, 1906. Duration of sunshine 67·9* hours and of R 52·2 hours.

Crowborough.—R was ·92 in. above the average, making the excess for the year equal to the average for March and April together. Mean temp. 37°·3, or 0°·5 below the average.

Hartley Wintney.—After the first week, which was dry, frost at night alternated with R during the day and strong N.W. and W. winds. Short, sharp TS with S, H and R on 8th. Mean amount of ozone 4·1.

Torquay.—Mean temp. 41°·8, or 1°·4 below the average. Duration of sunshine 121·4* hours, or 39·9 hours above the average. Mean amount of ozone 5·4. The sunniest February since 1891.

Wellington.—Stormy and colder than January with many small falls of S, but R only slightly above the normal.

North Cadbury.—A cold, raw month and the windiest February in 10 years. Great duration of R, but a fall only slightly above the average,

Worksop.—Unsettled but sunny, with many frosts, low pressure, and mean temp. 1°·5 below the average. Duration of sunshine the greatest in 25 years except in 1887.

Bolton.—Cold, wet and changeable, with mean temp. 36°·5, or 1°·1 below the average. Duration of sunshine 49·7* hours, or 10·3 hours above the average. A blizzard, with strong W.S.W. wind, T and L, occurred on 8th, the mean depth of S being about 5 inches.

Southport.—Exceptionally sunny, yet wet and stormy. Mean temp. 38°·2, or 0°·8 below the average, the extreme range being the smallest on record in February. Duration of sunshine 98·4 * hours, or 29·8 hours above the average, and of R 72·6 hours.

Carmarthen.—Unusually wet, with cold winds, sleet and cold R. Agricultural labour was retarded by the wet weather.

Haverfordwest.—Moderate R and unusually low day temp. not once reaching 50°. Duration of sunshine 80·3 * hours. Gales on five days.

Douglas.—Quite a winter month, wet and stormy with temp. below the average throughout, but no great cold and an excess of bright sunshine.

Coupar Angus.—Cold and stormy generally with several S storms. R ·71 in. below the average of 25 years. Mean temp. 35°·1, or 1°·4 below the average.

Lynturk Manse.—S lay on the ground throughout, and roads were more blocked than usual, owing probably to the frequent changes of wind.

Drumnadrochit.—The month was one prolonged S storm, but the temp. was fairly high and there were no very keen frosts. R ·49 in., and rainy days 2, above the average of 20 years.

Watten.—A series of gales, S and R storms, with some clear frosty days.

Darrynane Abbey.—Constant R but no very heavy fall, the total being only 4·2 per cent. above the average. About two inches of S on 11th.

Dublin.—Cold and changeable, with frequent but not heavy R, which often fell as H or sleet. Mean temp. 39°·7; low night temp., and max. reaching 50° on one day only.

Belfast.—R above the average and of infinite service to the soil. S and frost were more prominent than usual.

Omagh.—A raw, damp, and generally rainy month, but with no greater indication of winter than a few light night frosts and an occasional forenoon with the ground almost white with S.

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* Campbell-Stokes.

Climatological Table for the British Empire, September, 1905.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	76·5	3	42·7	15	65·9	50·1	51·0	83	118·7	36·6	2·09	12	6·0
Malta	92·1	26	65·3	22	85·6	71·5	68·6	75	141·8	61·7	·94	2	1·9
Lagos	86·0	9	71·0	2	83·0	74·0	72·0	78	144·0	62·5	1·54	13	7·2
Cape Town	80·7	17	44·0	16	65·0	52·1	50·4	75	...	...	1·59	7	5·8
Durban, Natal	84·6	29	50·6	18	76·3	59·2	...	...	138·4	...	2·39	16	4·8
Johannesburg	81·8	23	29·0	17	70·9	47·9	42·0	60	144·9	23·3	·22	4	2·6
Mauritius	81·2	21	53·2	2	79·1	62·4	62·2	76	145·8	42·7	2·00	12	5·9
Calcutta	93·0	19	74·6	29	88·3	78·2	77·5	85	166·2	73·1	11·20	18	7·7
Bombay	88·3	29	75·5	9	85·8	77·3	74·9	81	135·3	71·8	6·16	14	5·9
Madras	101·8	26	74·8	2	95·3	79·1	74·2	74	152·1	73·2	2·77	8	5·7
Kodaikanal	69·0	30	50·4	28	63·8	52·4	51·0	81	140·6	32·8	7·34	23	6·9
Colombo, Ceylon	88·4	3	73·2	6	86·1	76·2	74·3	82	149·2	70·0	10·75	20	5·8
Hongkong	89·6	2	71·3	19	84·7	76·5	73·7	81	142·9	...	3·20	15	6·5
Melbourne	70·0	13	32·0	18	56·4	42·0	39·5	74	129·5	25·0	2·46	16	6·8
Adelaide	75·1	12	35·9	28	52·0	43·5	40·7	72	133·6	31·5	1·51	17	5·9
Coolgardie	74·2	15	36·0	5	65·6	42·9	40·0	57	149·0	30·4	·70	6	3·7
Sydney	75·3	4	41·0	7	64·4	47·3	40·3	62	122·3	30·1	2·50	12	3·5
Wellington	59·5	1	38·5	30	55·5	45·7	43·3	77	116·0	33·0	6·02	18	7·0
Auckland	63·0	5	43·0	6	59·8	48·3	48·2	80	126·0	37·0	4·48	25	6·0
Jamaica, Negril Point	89·1	5	70·7	20	87·2	73·5	74·3	80	...	...	4·22	11	...
Trinidad	90·0	sev.	68·0	12	87·2	71·1	73·1	84	170·0	64·0	10·43	17	...
Grenada	88·6	17	72·0	7	84·8	75·0	72·5	76	150·0	...	5·42	20	3·3
Toronto	83·2	30	31·9	26	71·5	53·1	55·6	79	...	26·0	1·73	12	4·9
Fredericton	78·7	10*a*	29·5	15	65·8	45·5	46·7	64	...	...	3·25	13	6·1
Winnipeg	86·0	29	29·0	12	70·8	46·3	...	...	...	...	1·56	9	4·3
Victoria, B.C.	75·0	1	44·4	29	61·5	51·2	...	...	...	...	4·03	15	7·4
Dawson	58·4	1	18·8	20	45·7	33·3	...	...	...	...	3·52	15	6·8

a and 11.

MALTA.—Mean temp. of air 77°·4, or 2°·4 above, mean hourly velocity of wind 7·1 miles, or 0·7 below, average. Mean temp. of sea 79°·7.

Mauritius.—Mean temp. of air 0°·5, dew point 2°·0, and R ·61 in. above averages. Mean hourly velocity of wind 7·6 miles, or 4·4 below average. Mean computed direction E.

MADRAS.—Bright sunshine 150·7 hours.

KODAIKANAL.—Bright sunshine 122 hours.

HONGKONG.—Mean temp. of air 80°·1. Mean direction of wind E., and mean hourly velocity 14·8 miles. Bright sunshine 199·5 hours.

Adelaide.—Mean temp. of air 5°·1 below average. The coldest September in 48 years' record. R ·21 in. below average.

Sydney.—Temp. of air 2°·9 below, humidity 7·6 below, and R ·46 in. below, averages.

Wellington.—Mean temp. of air 1°·0 below, and R 1·50 in. above, averages.

Auckland.—Mean temp. of air slightly below average, and R 1·00 in. above the previous 37 years' average.

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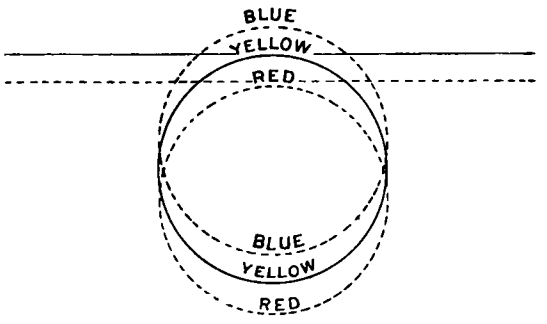
THE GREEN FLASH ON THE HORIZON.

By Arthur A. Rambaut, D.Sc., F.R.S.

(Continued from p. 23.)

Every astronomer is familiar with the fact that in a telescope the image of a star observed near the horizon is drawn out into a short spectrum. In the case of an object with a measurable disk, such as the sun or a planet, this effect becomes exceedingly troublesome when accurate measurements are required, even while the object is at a considerable altitude. The images formed by the variously coloured rays are not exactly superposed but fall as is shown in the diagram, in which, for simplicity, only the alternate colours, red, yellow and blue are indicated. It is obvious that, as the sun sinks in the west, the red image will be the first to disappear, then the yellow; and at the moment when the horizon is in the position indicated by the continuous straight line in the figure, it is clear that only blue light can reach the eye. This way of representing the facts also explains why at sunset the tips are the first to become green (when the horizon cuts through the yellow disk as indicated by the dotted line in the diagram), as is generally found to be the case if the flash is well seen with the aid of glasses. In the *Memoirs of the Royal Astronomical Society*, Vol. xlvi., p. 121, Sir David Gill draws attention to the effect of this inequality in the observations of Mars made at Ascension in 1877. The same effect was discussed by Airy, in the *Monthly Notices*, R.A.S., Vol. xxix., p. 333, when arranging for the observation of the Transit of Venus in 1874, and he proposed the use of a prism in the eyepiece of the telescope to correct the dispersion.



We have thus in the atmospheric dispersion of light a *vera causa* which must necessarily give rise to something in the nature of a green or blue flash. The only question is whether the dispersive effect is large enough to account for the flashes as actually seen. The following considerations will help us to come to a decision on this point.

Bouguer, in 1729, was the first to notice this atmospheric dispersion. Sir William Herschel, in 1785, and Stephen Lee, in 1815, tried to measure its amount. Robinson found that the image of Vega at its lower culmination at Armagh, when its altitude would have been about 3°, measured 22″ in a vertical direction. F. Struve found a similar extension of the image of Fomalhaut at its culmination above the horizon at Dorpat, and concluded that the atmospheric dispersion of the visible spectrum is about $\frac{1}{100}$th of the refraction. Airy estimates it at about $\frac{1}{60}$th of the refraction. If we consider any two rays, R and R′, and if we denote the refractive index of the air for R by μ, and that for R′ by μ'; then if β denote the coefficient of refraction for R and β' that for R′ we have approximately

$$(\beta' - \beta) / \beta = (\mu' - \mu) / (\mu - 1).$$

The difference $\beta' - \beta$ is the coefficient of dispersion for the two rays. Thus we see that the ratio of the dispersion to the total refraction is given by the expression $(\mu' - \mu) / (\mu - 1)$.

If now we take R to be the ray represented by the Fraunhofer line C in the red portion of the solar spectrum, and R′ to correspond to the line F in the green-blue, we have

$$\mu = 1{\cdot}00029383 \text{ and } \mu' = 1{\cdot}00029685,$$

from which we find that

$$\frac{\mu' - \mu}{\mu - 1} = \frac{302}{29383} = \frac{1}{98} \text{ approximately,}$$

thus agreeing very closely with Struve's estimate. On the other hand, if we had taken the Fraunhofer lines A, in the deep red, and G, in the deep blue, we should have found $\frac{1}{50}$ as the value of this expression. The true value is probably somewhere between these two extremes, and we cannot be far wrong if we take it to be $\frac{1}{72}$.

At the moment when the last red rays of the sun disappear beneath the horizon they are bent through an angle of about 36′ by the refraction, the exact amount depending on the condition of the air; but if we adopt the value, $\frac{1}{72}$, for the ratio of the dispersion to the refraction, we see that the rays at the other end of the visible spectrum are at the horizon refracted through an angle greater by $\frac{1}{72}$nd part than this, *i.e.*, through an angle of 36′·5. They will accordingly not wholly disappear until the sun has sunk to this depth beneath the horizon. The absence of the red rays will give a preponderance to the green and blue, so that we should expect a change of tint, passing through green to blue, to last while the sun was passing from a depth of 36′ to 36′ 30″ below the horizon. We have there-

fore to find the time occupied by the sun in passing through this angle of 30″, and it is not difficult to show that this time will be shortest if the observer is situated on the equator at the time of either equinox, and will then be equal to 2 seconds. In other latitudes where the sun crosses the horizon obliquely it may last much longer, and in the neighbourhood of the Arctic Circle it is conceivable that at midsummer the sun might pass so close below the horizon at midnight that the red rays would be cut off while the green and blue remained visible, and accordingly a "green flash" be seen, for more than 12 minutes. Farther north, the duration might extend to even greater length. As seen from either pole a prolonged display might be seen about the time of the equinoxes, as the sun passes from one side of the equator to the other; but the rapid movement of the sun in declination at these dates complicates the calculation, and in view of the scarcity of observers in those parts it seems hardly worth while to go more elaborately into the question. The value of 2 seconds found for the minimum duration agrees very well with the actual facts, most observers estimating it from barely 2, to 3 or 4 seconds of time.

With regard to the very pertinent question put by Admiral McClear, in his letter which appeared in this Magazine for January, viz.: "Why should the flash be green?" I would remark that the term "green flash" is from many points of view an unsatisfactory description of the phenomenon. When best seen the colour of the remaining segment of the sun at setting turns, at the very last moment, from green to blue. Many writers have described it as a *blue* flash, not *green* (see the remarks of the late Mr. Cowper Ranyard in *Knowledge*, April, 1889, and Prof. W. H. Pickering's paper in the *Monthly Notices*, both included in the list of references on pp. 21 and 22). Many of the passengers on board the *Durham Castle* described the flash seen over Guardafui on September 27th as blue, and, as already stated, one of the observers of the rising sun, on September 29th, preferred to describe the colour of the very first ray as blue rather than green. The fact that the flash does not appear indigo or violet is accounted for partly by the relative feebleness with which these rays impress the eye compared with the yellow, green and blue rays, and partly by the selective absorption of the atmosphere which cuts down the rays of shorter wave length in a larger proportion than those that are less refrangible. The violet and indigo are thus most reduced.

Professor Michie Smith, in his letter referred to above, questions the adequacy of the refraction theory to account for all the facts. He says, "If the phenomenon were due simply to refraction it would last for only a fraction of a second and the colour would be much more blue than green," and then he calls in the aid of absorption by dust—"water dust or other"—to supplement the refraction. As an effect of this dust-absorption the sun has been seen in India and other places of a pea green colour while still many degrees above the

horizon, an effect which was particularly striking shortly after the great eruption of Krakatoa in 1883, when the Earth's atmosphere was charged with immense masses of finely divided volcanic dust. But, although the effect of dust may perhaps sometimes intensify the blueness, it is, as I have already shown, not necessary to have recourse to this, the atmospheric dispersion alone being sufficient to account for the duration of the flash. The phenomenon is most frequently seen over a sea horizon, while a steady atmosphere and a calm sea appear to be usually associated with its appearance, a state of affairs in which the amount of fine spray—or, to use Prof. Michie Smith's expressive phrase, "water dust," in suspension close to the surface of the sea is a minimum. In this connection the observations described by Mr. Whitmell in the *Journal* of the B.A.A., xii. 289, are to my mind conclusive. He writes, "In the belfry of the Wesleyan Chapel, on the west side of Woodhouse Moor, there are narrow horizontal openings, through which, at certain times, the setting sun can send his rays to an observer at the large band-stand, about 300 yards away. On Saturday, 26th April, between $7\frac{1}{4}$ and $7\frac{1}{2}$ p.m., I was so exceptionally fortunate as to observe through the openings no fewer than three green and three red flashes. The red ones were seen just as the base of the sun successively revealed itself below each of the upper edges of three of the openings. The green ones were seen just as the top of the sun disappeared behind each of the lower edges of the openings." This is exactly what we should expect to see as the effect of the atmospheric dispersion of the light, but I find it impossible to conceive how *both* green and red flashes could be brought about by the absorption of dust.

These observations of Mr. Whitmell's suggested to me a method of seeing the green and red flashes any morning or evening when the sun is shining in a clear sky. For this purpose it is only necessary to place an opaque diaphragm in the focal plane of the objective of a telescope, so as to screen off one half of the field of view. The edge of the diaphragm should be very sharp and burnished, and should coincide with the diameter of the field. If the diaphragm is placed with its edge horizontal so as to obscure the lower half of the field of view, as projected on a white screen placed behind the eyepiece, then, as the sun sinks behind this artificial horizon line, the last narrow segment, corresponding to the highest point of the sun's limb, will become a vivid blue before disappearance. On the other hand, by rotating the diaphragm through 180° in its own plane so as to obscure the upper half of the field, and allowing the sun's image to emerge from behind it, the first segment, corresponding to the lowest point of the limb, will appear brilliantly red.

On the first occasion on which I had an opportunity of trying the experiment I did so, and though there was a thick haze near the horizon as the sun went down, I was able to exhibit these green and red flashes as often as I pleased. The observations were made

between 5 p.m. and 5.15 p.m., while the sun was sinking from an altitude of 5° 25′ to one of 3° 12′ above the horizon.

More recently I have had a diaphragm with a narrow diametral slit, about $\frac{1}{40}$ of an inch wide, inserted in the focal plane of a small telescope of $3\frac{1}{4}$ inches aperture. This slit takes the place of the openings in Mr. Whitmell's belfry, and the necessity for rotating the eyepiece is avoided. With this apparatus I have frequently shown the blue and red fringes at the top and bottom of the sun's disk. Unless the air is very unsteady the red fringe at the bottom is always conspicuous when the sun is low, but a haze near the horizon reduces the intensity of the blue-green fringe at the top. This will account for the fact that the "flash" is not more frequently seen in these latitudes. When the sky is free from haze the blue-green fringe is as striking as the red.

This is an observation by which any possessor of a telescope can easily satisfy himself that the flashes are due to atmospheric dispersion of light, and is at least less expensive than building a Wesleyan Chapel with horizontal openings in the belfry.

SCOTTISH METEOROLOGICAL SOCIETY.

A MEETING of the Society was held at 5, St. Andrew Square, Edinburgh, on March 12th, at 2.30 p.m., the Hon. Lord McLaren, President of the Society, in the chair.

The report from the Council was adopted, sympathetic reference being made to the faithful services of the late Miss Jessie Hill Buchan.

Dr. J. Halm contributed a paper under the title "The Influence of Atmospheric Temperature Conditions on Astronomical Observations." Experiments by the late Professor Langley had shown that, contrary to the conventional opinion, the definition of telescopic images was much clearer when the air in the neighbourhood of the instrument was agitated than when it was in a state of tranquillity. It was impossible to experiment with the general mass of the atmosphere, but we could note the differences in clearness of definition corresponding to various weather conditions. The blurring of the images was due, of course, to the passage of the light rays through atmospheric layers having different indices of refraction. Thus on theoretical grounds we should expect astronomical seeing to be best when the air was violently stirred by strong convection currents, for it was then that the state of adiabatic equilibrium was most nearly approached in which any given mass of ascending air assumed the exact temperature and density of the masses it successively displaced. On the other hand, seeing should be worst on clear winter nights when terrestrial radiation was most active and a slow sinking movement of the atmosphere disturbed the refrangibility of the successive layers. Experience agreed with theory. Thus Dr. Halm had found during his work in the conti-

nental climate of Strasburg, where the diurnal temperature range was large, that the images were clearest towards sunset on early summer evenings. Gradually as nocturnal radiation became more and more active, the images became blurred. Definition was quite unsatisfactory by two o'clock in the morning and worst about sunrise.

The suggestion was made that climatic and topographic conditions should be taken into account in selecting sites for new astronomical observatories. The slopes or neighbourhood of mountains should afford favourable positions, since there horizontal air currents were deflected upwards, so that the surrounding atmosphere was more or less disturbed and the desirable state of indifferent equilibrium more frequently and readily attained.

Professor Knott made the interesting observation that Sir Isaac Newton in his "Optics" had suggested that mountain summits should be favourable positions for astronomical work on account of the stillness of the atmosphere there! Newton had never dreamt that good definition depended on the commotion of the atmosphere rather than on its tranquillity.

In a paper "On Large Differences of Temperature between Ben Nevis and Fort William," by Mr R. T. Omond, it was pointed out that the average difference of temperature between the two observatories was 15°·5 F. By far the greater number of the hourly differences were somewhere near this value, but there were a few extreme cases ranging from a maximum difference of 28°·8 at 2 a.m. on 19th December, 1890, to a minimum at 9 a.m. on February 19th, 1895, when the summit of the mountain was no less than 17°·6 *warmer* than the base (Ben Nevis, 33°·6; Fort William, 16°.0). During a period of thirteen and a-half years there had been only 205 hours at which there was a difference of at least 25°. Though the extreme case had occurred on a winter's night, almost all the cases of large differences had been on summer afternoons, invariably with dry air at Fort William and nearly always with strong winds. There had been only three occasions on which a temperature difference of 25° or over had continued for more than four consecutive hours. On the other hand, actual inversions of temperature might persist continuously for many hours, or even for two or three days, in succession. The adiabatic rate of change of temperature in the case of dry air corresponded to a temperature difference of about 24° in an air column 4,400 feet in height, and the rarity of differences larger than this appeared to indicate that the adiabatic limit was a definite controlling factor in fixing approximately an upper limit to the variations of the difference of temperature between the summit and base of the mountain. That when the adiabatic difference was exceeded the air column was in a state of instability was shown by the fact, already indicated, that the occurrence of very large differences had never been long continued.

Mr. Omond's paper was followed by an interesting discussion, in which Professor Knott, Dr. Halm, Dr. Buchan and Lord McLaren took part.

METEOROLOGICAL OBSERVATIONS TAKEN DURING 1905 AT BANANI, PEMBA, NEAR ZANZIBAR.

WE are again indebted to Mr. T. P. Newman for particulars of the meteorological observations taken by Mr. Theodore Burtt, of the Friends' Industrial Mission at Pemba.

1905.	Mean Max.	Mean Min.	Absolute Max.	Absolute Min.	Rainfall.	Rain Days
	°	°	°	°	in.	
January	83·8	73·7	87·0	72·0	·63	5
February	83·8	73·5	87·0	72·0	·23	2
March	82·8	73·3	90·0	70·0	12·52	15
April	80·0	71·7	88·0	68·5	39·01	25
May	79·8	70·6	83·0	69·0	14·44	21
June	80·0	69·4	83·0	66·0	6·19	14
July	78·2	68·5	81·0	65·0	3·58	15
August	78·5	68·2	79·0	66·0	2·35	16
September	79·9	69·1	84·0	64·0	3·54	7
October	83·5	70·6	87·0	68·0	2·92	8
November	84·4	73·3	90·0	71·0	4·98	11
December	84·1	73·9	90·5	70·0	10·89	14
Year	81·6	71·3	90·5	64·0	101·28	153

Extreme Range of Temperature..... 26°·5

Mr. Burtt appends to his report the following remarks on the year :—

As will be seen by comparison with the observations recorded in *Symons's Meteorological Magazine* for March, 1905, the past year shows a slight fall in temperature ; this is, no doubt, owing to the unusual amount of cloud which we had. It is interesting to notice the considerable increase in the rainfall—the largest since 1899. I am still of opinion that the light rainfall which we have experienced during the past few years has been abnormal. The autumn (?) rains which usually fall in November were late this year, scarcely getting over before the year closed.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, March 21st, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

The following were elected Fellows :—Mr. C. Anthony, junr., M.Inst.C.E., Mr. L. C. W. Bonacina, Miss E. H. Cordner, Capt. R. H. Douglas, Raja Kushal Pal Singh, M.A., Mr. R. H. Rhind, Prof. A. Schuster, F.R.S., Mr. M. Sutton and Mr. W J. Ware.

This being the "popular" meeting of the session, Dr. H. R. Mill, at the request of the Council, gave a lantern lecture on "South Africa as seen by a Meteorologist." The lecture was illustrated by more than sixty lantern slides from photographs taken by the lecturer during the African wanderings of the British Association in 1905, and bearing some relation to the climate of the countries passed through. While no attempt was made to give an account of the climate of South Africa or a detailed description of the observing stations maintained in the various colonies, a general idea was conveyed, as much in pictures as by words, of the actual condition of things. Travelling in the dry season, the lecturer was naturally impressed with the drought and dust, and had much to say on the importance of systematic irrigation if the natural resources of the country are to be developed to the full. A detailed report here is unnecessary, as a description of the British Association trip has already appeared in this Magazine.

On the motion of the President, seconded by Mr. F. Campbell Bayard, a hearty vote of thanks was accorded to the lecturer.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

SNOW ON THE SURREY HILLS.

THE remarkable phenomenon noted by Mr. B. (p. 29) came under my own observation so recently as March 14th, at 1.55 p.m. By that hour the snow fallen in the night *had actually disappeared* from the southern slopes of the North Downs (N.W. of Dorking)—chalk, with patches of tertiary sands on top in parts—but *was still lying* on the northern slopes of Leith Hill, S.W. of the town, which are lower greensand. Another remarkable and most unusual fact is that the sun had been shining for some hours. The northern slopes of the North Downs and southern slopes of Leith Hill were beyond Mr. B.'s vision and mine; but it is safe to say that the answer to the first part of the editorial question is NO.

LOCAL WISEACRE.

Dorking, March 18th, 1906.

IN reply to the question raised by you in your editorial note to my letter in the March number on the localization of snow on the Surrey Hills, on the 24th of February, I have to say that I noticed that

snow was entirely absent from the northern slopes of the portion of the North Downs in question, and that it was present on all sides of the Leith Hill ridge except the western, which I did not see, though at midday the snow had commenced to melt rapidly under the combined influence of warm sunshine and the setting in of a moist south-westerly air current. I have to note, however, that on the morning of the 24th of March I met with an instance of a thaw progressing very slowly on the chalk of the North Downs near Oxted, but very rapidly on the green-sand of the Ide Hill range running parallel to the North Downs between Oxted and Sevenoaks. On the morning of that date the sky was entirely overcast, and the temperature of the air about 36° F.

Though these observations made during February and March on the distribution of snow-covered ground in a few localities in Surrey and Kent have been through force of circumstances fragmentary, they would seem to indicate appreciable differences in the condition of the surface rocks with respect to temperature and humidity.

Two parallel ranges of hills like those in question—the one composed of chalk and covered with thin turf, the other composed of sandstone, with a surface consisting largely of barren heath-land—are obviously far more likely, owing to the different physical constants of chalk and sandstone, to vary in surface temperature at any particular time than two parallel ranges of hills composed of the same kind of rock and productive of the same kind of vegetation. I would strongly urge that some attention be paid to the subject of the permanence of layers of snow over different geological formations by observers in this country while making notes upon future falls of snow, as in this way it may be possible to ascertain definite relationships amid seemingly disconnected phenomena. I find that the subject of soil temperature in connection with snow-covering has been studied in Germany. (*Deutsches Meteorologisches Jahrbuch für* 1901).

The character of the snow-clouds, with respect to crystalline texture, boldness of form, and sharpness of outline, has this month been very beautiful and typical of the early spring. Late in the afternoon of the 24th instant, as I was watching from the summit of Ide Hill the dark rugged masses of cumulo-form clouds delicately underlined with silver or tinged with pink, and the squalls of snow amid ever-varying effects of light and shadow, drift slowly across the richly-wooded weald of Kent, I could not but feel that it is in harsh seasons like the present, when the returning sun must make a fierce struggle with the forces tending to protract the cold, that the spirit of the early spring in the open country in these higher latitudes is most magnificently expressed.

L. C. W. BONACINA.

March 27th, 1906.

COLD IN FEBRUARY AND MARCH.

It is a curious fact (perhaps nothing more) that in each case of the last five sunspot maxima, the year following has had both February and March warm. Assuming last year (1905) to be a maximum year, it seemed not unlikely that the two months this year would "follow suit." They have not done so, being both cold. There seems to be good evidence of a general tendency to earlier springs (in our London region, at least) about the time of sunspot maxima. Individual years are of no great account, I take it, in these inquiries. It will be of more interest to see whether groups of (say) five years about and after the present maximum, present an average February-March temperature conforming to past experience.

Another view may be taken. With two big spots on the sun at present (4th April), it may perhaps be doubted whether we have passed the maximum yet.

In a recent letter I referred to the idea of our air temperature going down in consequence of a large quantity of ice melting in the Gulf Stream, and the cooled water reaching our shores after a considerable interval. I would here pursue this idea a little further.

Dr. Meinardus recently gave a table in which the character of each season at Newfoundland (from 1860 to 1902), as regards ice, was expressed numerically according to the scale, -2, -1, 0, $+1$, $+2$, where -2 indicated *little* ice, and $+2$ *much* ice.* I have compared each of these annual numbers (*a*) with the cold at Greenwich in the latter part of the *same* year, and (*b*) with that in the earlier part of the *following* year.

The inquiry into (*a*)—comparison being made in the number of frost days in the later half of the same year—revealed nothing very definite; no special tendency. But in the case of (*b*) there is, I think, something of that nature.

Thus, there were 10 years at Newfoundland with values $+2$ or $+1{\cdot}5$ (much ice), and 8 of these were followed by an *excess* of frost days in the earlier half of the next year at Greenwich, 2 by a deficiency. On the other hand, out of 9 years with values -2 or $-1{\cdot}5$, 7 were followed by *little* frost at Greenwich in the earlier half of the next year, while in 2 there was (slight) excess.

The mean temperature of each of the first three months appears to be marked by this tendency, which is most pronounced in March. Thus, there were in all 19 seasons at Newfoundland with ice in excess of the average, and of these 14 were followed in Greenwich by cold Marches. Similarly of 19 seasons with ice under average, 14 were followed by warm Marches.

Last year (1905) there was much ice in the Newfoundland region, but I am unable to say how precisely it would be characterised in the above scale. Are we to suppose, in view of the figures just given,

* A translation of Dr. Meinardus's important paper will be found in the *Quarterly Journal* of the Royal Meteorological Society for January last.

that our recent cold in those two months has been due to an ice-cooled Gulf Stream? The facts seem, at least, to suggest the desirability of further observation of those relations. A timely warning of excessive cold in the early part of the year might possibly be found in the reports of the Newfoundland ice in the previous spring and summer.

ALEX. B. MACDOWALL.

Southgate, Buxton, 4th April, 1906.

UNUSUAL SKY COLOURS.

YESTERDAY at 7 p.m. the entire canopy of the heavens in Torquay was diffused with a brilliant light green, having slight traces of yellow, N.N.W. on the immediate horizon. This was succeeded by a brilliant ultramarine blue, radiating also from the N.N.W. The entire day and Monday were remarkably bright and clear.

HENRY BEDFORD.

St. Michael's View, Crown Hill, Torquay, April 4th, 1906.

REVIEWS.

Cloud Studies. By ARTHUR W. CLAYDEN, M.A., *Principal of the Royal Albert Memorial College, Exeter.* London: John Murray. 1905. Size 8 × 6. Pp. xiv. + 184; 61 Plates. Price 12s. net.

ONE of the books which is not only worth reading, but worth buying. Mr. Clayden writes shortly, but all he says is fresh, solid and interesting, while the beautifully reproduced photographs of clouds are the finest we have seen. The difficulty of obtaining a clear photograph of a faint white cloud on a deep blue sky is pretty familiar to all who have handled a camera; but the methods of overcoming the difficulty here expounded will be new to most amateurs. Some of Mr. Clayden's finest results, showing the exquisitely minute structure of the faintest and loftiest clouds, were obtained by directing the camera, not towards the cloud itself, but towards the reflection in a mirror of black glass, set at an angle which reduces the intensity of the polarized light of the blue sky while giving full effect to the unpolarized light reflected by the white cloud.

Mr. Clayden executed a series of important cloud measurements for altitude at Exeter by the device of having two cameras at the end of a measured base of 200 yards, each pointed so as to include in the same picture the cloud under observation and the sun. Knowing the date and hour, nothing further is required in order to obtain the height of any part of the cloud above the surface by simple measurement on the plate. The greater part of the book, however, is devoted to a discussion of the minor differences in the

recognized cloud forms, and although at first sight the number of sub-forms strikes one as alarmingly large, the illustrations seem to justify them.

The basis of the classification is that formally adopted by the International Meteorological Committee and embodied in the well-known International Cloud Atlas. Mr. Clayden does not look on this classification with unmixed approval, but with a caution and consideration which cannot be too much praised he refrains from putting forward a new system, trusting that in time the classification will be overhauled by the authoritative body which introduced it. He adds to the classification, however, by suggesting a large number of specific forms of the accepted cloud genera, and he proposes names for these, some of them adopted from Clement Ley, many of which will probably pass into use. He gives, for instance, nine distinct forms of Cirrus, viz., *Cirro-nebula*, *Cirro-filum*, *Cirrus excelsus*, *Cirrus ventosus*, *Cirrus nebulosus*, *Cirrus caudatus*, *Cirrus vittatus*, *Cirrus inconstans*, and finally *Cirrus communis*. The other cloud forms are similarly dealt with.

A very interesting part of the book is the attempt to associate the particular forms of the clouds, and the changes which these forms undergo, with the physical conditions giving rise to them. In this connection the study of the cumulo-nimbus, or thunder cloud, strikes us as particularly happy, while there is a great deal of acute observation and careful reasoning in the short chapter devoted to wave-forms in clouds. The work of Mr. Clayden is a solid contribution to what may be called the vertical exploration of the atmosphere, a direction in which the early years of the twentieth century have already witnessed great progress. Apart from its scientific value, the book will appeal to many who are mere Gallios in meteorology on account of the exquisite beauty of the illustrations.

An Introduction to Practical Geography. By A. T. SIMMONS, B.Sc., and HUGH RICHARDSON, M.A. London: Macmillan & Co. 1905. Size 7 × 4½. Pp. xii. + 380.

A BOOK of admirable intentions very well carried out. It consists largely of a series of exercises in geometrical drawing and calculation adapted to the construction, interpretation and use of maps illustrating all sorts of distributions; but it also contains excellent practice in out-of-door work invaluable to a student of geography. Our readers will probably find the chief interest and utility of the book in its treatment of the diagrammatic representation of variable quantities. More than 100 pages are devoted to Climate, and although this section is well and conscientiously done, a few points present themselves for comment from the point of view of a meteorologist. For instance, on p. 215, the ordinary hours for reading meteorological instruments in this country (9 a.m. and 9 p.m.) are not mentioned, though several quite unusual hours are quoted. We

note with surprise, on p. 225, the use of the extremely objectionable expression, "above or below the equator," when "north or south of the equator" is meant. On p. 232, "Tropical" is inadvertently used in the second table for places all of which lie outside the tropics. On p. 235, the latitude of Ben Nevis as given would sink that mountain and the remains of its observatory in the deep sea. The rain gauge figured on p. 278 is a pattern which should be avoided as it combines the worst defects of two practically obsolete types, while the measuring glass shown beside it can measure only ·45 in. These defects are serious in a book for the use of children at school, but after all this is not a heavy list of matters needing amendment in over 100 pages written by authors who are not specialists, and we have pleasure in welcoming and commending the little book.

Ueber die räumliche und zeitliche Verteilung des Wärmegehalts der unteren Luftschicht, [On the distribution in space and time of Heat in the lower stratum of the atmosphere.] Von WALTER KNOCHE. *Aus dem Archiv der Deutschen Seewarte* xxviii. *Jahrgang*. Hamburg: 1905. Size $11\frac{1}{2} \times 9\frac{1}{2}$. Pp. 46. Plates.

THE author deals with the distribution of heat, not of temperature, and following von Bezold he uses as an index of the heat in the atmosphere the "equivalent temperature," that is the temperature of the air increased by an amount equivalent to the latent heat present. This thermodynamic treatment throws light on some of the apparent anomalies of the distribution of climate when the actual temperature alone is considered, and the author permits himself to hope that further studies in this direction may yield results of practical value in improved weather forecasts.

The Hygiene of the Zones. By ROBERT DE C. WARD. Reprinted from the Bulletin of the Geographical Society of Philadelphia. Vol. 4. No. 2. January, 1906. Size 9 × 6. Pp. 28.

AN attempt to give a brief survey of some of the relations between weather and climate and a few of the more important diseases. The author shows by many instances that the influence of climate in the production of disease is by no means so great as was formerly supposed, yet that it acts in many ways, direct and indirect. Hygiene is more than climate, yet climate has to be considered, because it affects our bodily comfort, may depress or exhilarate, may induce to remain indoors inactive or tempt to exercise in the open air. In connection with this paper we are reminded of the Committee of the British Association which is now at work, under the presidency of Sir Lauder Brunton, investigating the relation between climate and disease. Anyone able to afford information on the subject should apply to the Secretary of the Committee, Mr. J. Barcroft, King's College, Cambridge.

Some Aspects of Meteorology. By HENRY MELLISH. (*Reprinted from the 53rd Report and Transactions of the Nottingham Naturalists' Society for 1904-05.*) Size 9 × 5½. Pp. 8. Plates.

IN this interesting little paper Mr. Mellish gives a rainfall map of Nottinghamshire based on 30 years' averages, and refers in some detail to several aspects of the problem of the distribution and the destination of rainfall.

METEOROLOGICAL NEWS AND NOTES.

A COURSE OF FOUR LECTURES ON METEOROLOGY, at the University of London, South Kensington, is announced. The subject is "The Atmospheric Circulation and its relation to Weather," and the lectures will be given at 5 p.m., on May 1st, 8th, 15th, and 24th, 1906, by Dr. W. N. Shaw, Director of the Meteorological Office. The following is a syllabus of the lectures :—

I. Atmospheric currents and the distribution of pressure over the globe. Buys Ballot's law and its dynamical significance. Forces which guide the motion of air. Currents in the upper air as determined by observations of cloud and by calculation of the distribution of pressure.

II. Persistent and periodical winds, tropical revolving storms, cyclonic depressions of middle latitudes and the weather associated with them.

III. The normal general circulation at the surface and in the upper air. Relation of temperature and rainfall to the general circulation and local disturbances.

IV. Variations in the several elements of the circulation from year to year. The relation of wheat crop to rainfall and its meteorological significance. Sequences in seasonal variations, with illustrations from the Meteorology of Indian Ocean and of the Atlantic Ocean. Attempts to identify the law of sequence of meteorological changes.

There is no fee for the lectures, and cards of admission may be obtained on application to the Academic Registrar, Mr. P. J. Hartog, The University of London, South Kensington, S.W.

THE METEOROLOGICAL OFFICE has appointed as Superintendent of the Statistical Branch, Mr. R. G. K. Lempfert, whose duties, we understand, will include the preparation of the Weekly Weather Report, and the Reports for the Registrars General of England and Ireland, which are prepared by the Meteorological Office, as well as the supervision of the Library. As Superintendent of the Instruments Branch Mr. Ernest Gold, a distinguished graduate of the University of Cambridge, has been appointed. Mr. J. A. Curtis succeeds Mr. J. S. Harding as Cashier and Chief Clerk of the Office.

MR. H. E. WOOD, formerly demonstrator in the Physical Laboratory in the University of Manchester, has been appointed Assistant Meteorologist in the Johannesburg Observatory of the Transvaal Government.

THE CAMBRIDGE AND HUNTINGDONSHIRE RAINFALL TABLE has been published monthly for circulation amongst the rainfall observers in those counties for twenty years. Conducted at first by Mr. H. G. Fordham and latterly by Mr. Harold Warren, C.E., it was in danger of lapsing when the last-named gentleman left Cambridge early in the present year. The Editor of "British Rainfall," being unwilling to see any well designed plan for promoting interest in so important a matter as the rainfall of two prominent agricultural counties fall to the ground, offered to continue the Table as part of the work of the British Rainfall Organization, if no volunteer were forthcoming to carry it on. He has been held to his word; and readers of this Magazine in the counties mentioned who would care to have the Table and do not already receive it are invited to communicate with the Editor.

TELEGRAPHIC DELAYS owing to the destruction of posts and wires during gales and snowstorms have frequently been commented on in our winter numbers, and it is a pleasure to be able now to record the completion of an underground telegraph cable for the 400 miles from London to Glasgow which may be depended upon to prevent an absolute suspension of communication from south to north in bad weather. The work, which has been carried out by the Post Office, was costly—the sum of £2,000,000 has been mentioned in the newspapers—but the practicability of long underground cables has been proved, and this is another step towards the emancipation of humanity from the adverse powers of the air.

LONG PERIOD WEATHER FORECASTS have always been viewed by meteorologists in an atmosphere of doubt mingled with hope, and confirmation of the following cutting from one of the many newspapers of March 29th which published it will be awaited with interest:—

NEW YORK, March 28.—At a banquet which was given here yesterday evening by the Maritime Association, Mr. Moore, chief of the Weather Bureau, announced that the Bureau believed it had a basis for forecasting the general character of the weather a month in advance, and that it expected to inaugurate a service of this character within a year.—*Reuter.*

EASTER WEEK frequently presents to the Editor of a monthly publication the alternative of going to press too early, and thereby leaving undone some of his best intentions, or of going to press too late, and losing such character for promptitude as he may possess. We have chosen the former alternative, hence there is no article on the rainfall of the winter six months of 1905-06.

TEMPERATURE FOR MARCH, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32°. Shade.	Grass.
Camden Square	*London*	51 32	0 8	111	65·1	7	27·3	23	9	20
Tenterden	*Kent*	51 4	*0 41	190	62·0	7	27·5	24	9	20
Hartley Wintney	*Hampshire*	51 18	0 53	222	60·0	7, 18	24·0	23	10	17
Hitchin	*Hertfordshire*	51 57	0 17	238	65·0	7	24·0	22	15	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	67·0	7	23·0	30	15	20
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	67·0	7	25·0	13	...	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Alderbury	*Wiltshire*	51 2	1 44	263	63·0	7	22·0	22	14	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	56·2	6	22·7	30	11	15
Torquay (Cary Green)	*Devon*	50 28	3 32	12	58·5	6	31·6	23	1	21
Polapit Tamar [Launceston]	,,	50 40	4 22	315	61·0	17	24·0	29	10	13
Bath	*Somerset*	51 23	2 21	67	65·0	17	24·5	30	13	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	60·0	6, 7	28·0	25	10	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	58·0	17	20·0	26	23	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	60·0	8, 17	21·0	29	16	...
Boston	*Lincolnshire*	52 58	0 1	25	60·0	6	26·0	14	13	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	62·9	7	23·7	14	12	19
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	63·0	8	26·0	12	13	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	54·5	17	23·8	13	11	19
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	61·0	6,7,17	19·0	14	11	23
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	50·5	20	17·3	14	10	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	56·2	17	28·3	30	5	19
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	...	...	...	...	...	...
Llandudno	*Carnarvon*	53 20	3 50	72	54·0	17	27·0	13	4	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	54·0	16	17·0	14	9	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	50·0	6†	10·0	13	14	25
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	54·1	16	19·4	13	10	19
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	53·0	6	12·0	13	11	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	55·0	30	14·0	13	13	26
Tighnabruaich	*Argyll*	55 55	5 14	50	48·0	20‡	20·0	13	18	20
Mull (Quinish)	,,	56 36	6 13	35	49·0	31	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar* ..	56 28	2 57	199	54·6	30, 31	18·6	14	16	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	51·0	30, 31	14·0	13	16	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	53·0	17	19·5	13	15	...
Castletown	*Caithness*	58 35	3 23	100	53·0	16 §	25·0	13	8	18
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	59·0	17	28·0	26	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	56·0	15	29·0	3	3	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	53·0	31	28·0	25	8	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	59·9	16	31·9	3	3	12
Ballinasloe	*Galway*	53 20	8 15	160	60·5	6	22·0	28	14	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	..	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	55·0	6	20·0	12	8	12
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	54·0	16	20·0	12	8	17

† and 28, 30. ‡ and 23, 30. § and 17, 30.

RAINFALL FOR MARCH, 1906.

	RAINFALL OF MONTH.						RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
r. 99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.		
	in.	in.		in.	Date.		in.	in.	in.		in.	
2	1·08	— ·54	67	·32	10	17	5·13	6·99	+1·86	136	25·16	Camden Square
9	1·77	— ·12	94	·37	10	19	6·10	7·63	+1·53	125	28·36	Tenterden
7	1·50	— ·27	85	·29	10	19	6·22	7·79	+1·57	125	27·10	HartleyWintney
3	1·83	+ ·30	120	·29	25	16	4·88	7·00	+2·12	143	24·66	Hitchin
2	1·54	— ·08	95	·34	10	19	5·40	7·06	+1·66	131	26·75	Addington
4	2·12	+ ·48	129	·26	1	20	4·89	8·15	+3·26	167	25·39	Westley
5	2·16	+ ·51	131	·35	24	21	4·81	8·68	+3·87	181	25·40	Brundall
8	·63	—1·15	35	·14	13	14	6·66	9·06	+2·40	136	29·17	Alderbury
1	1·51	— ·90	63	·40	13	11	9·42	14·60	+5·18	155	39·00	Winterbourne Stpltn
5	1·00	—1·45	41	·27	13	11	8·51	11·02	+2·51	129	35·00	Torquay
1	2·02	— ·39	84	·58	1	16	9·12	14·82	+5·70	163	38·85	Polapit Tamar
4	1·69	— ·25	87	·45	10	16	6·58	8·04	+1·46	122	30·75	Bath
6	1·53	— ·33	82	·40	10	17	6·45	8·05	+1·60	125	29·85	Stroud
1	1·40	— ·61	70	·26	7	17	7·09	8·21	+1·12	116	33·04	Woolstaston
6	·82	— ·54	60	·23	10	11	4·90	5·87	+ ·97	120	24·50	Bromsgrove
6	1·76	+ ·40	129	·30	23	18	4·50	6·66	+2·16	148	23·30	Boston
5	1·28	— ·27	83	·24	1	16	4 87	6·15	+1·28	126	24·70	Hodsock Priory
9	1·51	+ ·02	101	·32	1	17	5·10	7·36	+2·26	144	26·18	Derby
8	3·35	+ ·47	116	·78	7	17	8·93	14·34	+5·41	161	42·43	Bolton
5	1·53	— ·32	83	·37	24	16	5·37	7·53	+2·16	140	26·96	Ribston Hall
3	6·37	+1·34	127	1·55	7	23	16·10	22·02	+5·92	137	60·96	Arncliffe Vic.
9	1·65	— ·14	92	·21	18	17	5·45	5·86	+ ·41	108	27·02	Hull
0	1·24	— ·86	59	·22	10	15	5·64	4·71	— ·93	84	27·99	Newcastle
1	9·38	—1·13	89	1·56	15	17	36·86	38·65	+1·79	105	132·68	Seathwaite
9	3·12	+ ·33	112	1·07	10	15	9·77	14·81	+5·04	152	42·81	Cardiff
3	2·97	— ·06	98	1·12	10	16	11·86	14·37	+2·51	121	47·88	Haverfordwest
3	3·81	+ ·88	130	1·17	10	15	9·83	15 20	+5·37	155	45·41	Gogerddan
7	3·15	+1·18	160	·88	7	15	6·51	9·97	+3·46	153	30·98	Llandudno
1	2·49	— ·52	83	·52	10	12	11·17	9·86	—1·31	88	43·43	Cargen
0	1·60	— ·80	67	·38	11	15	7·41	6·02	—1·39	81	33·04	Riddell House
	1·97	...	...	·57	11	14	...	6·09	..	.	...	Edinburgh
8	2·62	— ·56	82	·58	14	13	11·37	10·35	—1·02	91	44·85	Colmonell
3	3·53	+1·20	152	1·10	14	9	8·11	11·14	+3·03	137	35·80	Glasgow
6	5·35	+ ·99	123	1·59	16	14	14·79	18·74	+3·95	127	57·90	Tighnabruaich
3	2·68	—1·55	63	·76	16	19	14·58	14·14	— ·44	97	57·53	Quinish
2	1·05	— ·87	55	·25	11	12	6·12	3·80	—2·32	62	28·95	Dundee
2	2·96	+ ·54	122	...	...	...	8·03	9·46	+1·43	118	36·07	Braemar
3	2·20	— ·23	91	·45	11	20	7·18	6·29	— ·89	88	33·01	Aberdeen
6	2·92	+ ·76	135	·53	16	19	6·16	7·86	+1·70	128	29·37	Cawdor
3	3·30	—1·53	68	·95	16	6	16·35	18·25	+1·90	112	56·00	Invergarry
8	8·52	+2·14	134	1·75	6	29	21·90	29·72	+7·82	136	86·50	Bendamph
7	2·41	— ·06	98	·54	14	12	7·48	11·09	+3·61	148	31·60	Dunrobin Castle
.	2·31	.	...	·37	8	26	...	11·55	...	...	...	Castletown
3	2·52	—1·51	63	·66	11	17	16·04	13·52	—2·52	84	58·11	Killarney
5	1·81	— ·74	71	·45	10	14	9·91	10·36	+ ·45	104	39·30	Waterford
7	2·26	+ ·09	104	·38	10	15	7·34	10·49	+3·15	143	33·47	Hurdlestown
6	2·56	+ ·30	113	·60	10	15	8·02	9·04	+1·02	113	34·44	Carlow
5	1·52	— ·33	82	·48	10	17	5·99	7·29	+1·30	122	27·75	Dublin
5	2·58	+ ·13	105	·64	10	19	8·42	11·32	+2·90	134	37·04	Ballinasloe
7	3·46	—2·21	61	·82	10	14	19·61	20·59	+ ·98	105	80·23	Kylemore House
5	3·53	— ·42	89	·73	10	19	12·96	15·45	+2·49	119	50·50	Enniscoe
6	1·97	— ·59	77	·40	1	15	9·16	7·99	—1·17	87	38·61	Seaforde
6	3·39	+ ·33	111	·66	11	20	9·35	13·10	+3·75	140	41·20	Londonderry
7	3·60	+1·13	146	·61	14	18	8·30	11·94	+3·64	144	37·85	Omagh

SUPPLEMENTARY RAINFALL, MARCH, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	1·86	XI.	Rhayader, Tyrmynydd	5·61
,,	Ramsgate, West Cliff Villas	1·74	,,	Lake Vyrnwy	5·08
,,	Hailsham	1·65	,,	Llangyhanfal, Plâs Draw....	2·38
,,	Crowborough, Uckfield Lodge	2·41	,,	Criccieth, Talarvor.....	2·87
,,	Osborne, Newbarn Cottage.	1·36	,,	Llanberis, Pen-y-pass	13·50
,,	Emsworth, Redlands..... ..	1·32	,,	Lligwy	3·03
,,	Alton, Ashdell	1·50	,,	Douglas, Woodville	2·31
,,	Newbury, Welford Park ...	2·02	XII.	Stoneykirk, Ardwell House	1·59
III.	Harrow Weald, Hill House.	1·34	,,	Dalry, The Old Garroch ...	4·73
,,	Oxford, Magdalen College..	1·27	,,	Langholm, Drove Road.....	...
,,	Bloxham Grove	1·14	,,	Moniaive, Maxwelton House	3·39
,,	Pitsford, Sedgebrook.....	1·32	XIII.	N. Esk Reservoir [Penicuick]	3·35
,,	Huntingdon, Brampton.....	1·84	XIV.	Maybole, Knockdon Farm..	3·29
,,	Wisbech, Bank House	1·66	,,	Campbeltown, Witchburn...	3·15
IV.	Southend Water Works.....	1·11	XV.	Inveraray, Newtown	6·28
,,	Colchester, Lexden.....	1·51	,,	Ballachulish House.....	6·31
,,	Newport, The Vicarage.....	1·79	,,	Islay, Eallabus	3·43
,,	Rendlesham.....	1·85	XVI.	Dollar Academy	3·17
,,	Swaffham	1·74	,,	Loch Leven Sluice	2·68
,,	Blakeney	1·53	,,	Balquhidder, Stronvar	...
V.	Bishops Cannings	1·79	,,	Perth, Pitcullen House.....	1·92
,,	Ashburton, Druid House ...	1·75	,,	Coupar Angus Station	1·19
,,	Okehampton, Oaklands.....	2·79	,,	Blair Atholl.....	2·22
,,	Hartland Abbey	1·67	,,	Montrose, Sunnyside Asylum	·33
,,	Lynmouth, Rock House ...	2·84	XVII.	Alford, Lynturk Manse ...	2·40
,,	Probus, Lamellyn	1·19	,,	Keith Station	3·03
,,	Wellington, The Avenue ...	1·71	XVIII.	N. Uist, Lochmaddy	1·61
,,	North Cadbury Rectory ..	1·54	,,	Alvey Manse	2·84
VI.	Clifton, Pembroke Road ...	2·81	,,	Loch Ness, Drumnadrochit.	3·50
,,	Moreton-in-Marsh, Longboro'	1·52	,,	Glencarron Lodge	9·46
,,	Ross, The Graig	1·10	,,	Fearn, Lower Pitkerrie.....	1·56
,,	Shifnal, Hatton Grange.....	1·26	XIX.	Invershin	2·45
,,	Cheadle, The Heath House.	2·43	,,	Altnaharra	4·16
,,	Coventry, Kingswood	1·37	,,	Bettyhill	2·92
VII.	Market Overton	1·46	,,	Watten Station	1·37
,,	Market Rasen	2·14	XX.	Dunmanway, The Rectory..	3·15
,,	Bawtry, Hesley Hall.....	·82	,,	Cork	1·16
VIII.	Neston, Hinderton.....	1·83	,,	Darrynane Abbey	2·33
,,	Southport, Hesketh Park...	2·58	,,	Glenam [Clonmel]	2·30
,,	Chatburn, Middlewood	4·27	,,	Ballingarry, Gurteen	2·46
,,	Cartmel, Flookburgh	3·95	,,	Miltown Malbay.....	3·29
IX.	Langsett Moor, Up. Midhope	4·20	XXI.	Gorey, Courtown House ...	1·86
,,	Scarborough, Scalby	2·16	,,	Moynalty, Westland	2·16
,,	Ingleby Greenhow	2·11	,,	Athlone, Twyford	2·45
,,	Mickleton.....	2·10	,,	Mullingar, Belvedere.....	1·92
X.	Bardon Mill, Beltingham ...	2·03	XXII.	Woodlawn	3·02
,,	Ewesley, Fallowlees	...	,,	Westport, Murrisk Abbey..	3·37
,,	Ilderton, Lilburn Cottage..	1·58	,,	Collooney, Markree Obsy..	3·72
,,	Keswick, York Bank.....	4·02	XXIII.	Enniskillen, Portora	2·58
XI.	Llanfrechfa Grange.....	2·37	,,	Warrenpoint, Summer Hill.	1·49
,,	Treherbert, Tyn-y-waun ...	6·34	,,	Banbridge, Milltown	1·76
,,	Carmarthen, The Friary.....	3·03	,,	Belfast, Springfield	2·96
,,	Castle Malgwyn [Llechryd].	3·20	,,	Bushmills, Dundarave	2·46
,,	Plynlimon.....	11·20	,,	Stewartstown, The Square..	2·70
,,	Tall-y-llyn.....	2·60	,,	Killybegs	4·82
,,	New Radnor, Ednol	3·04	,,	Horn Head	3·97

METEOROLOGICAL NOTES ON MARCH, 1906.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

London, Camden Square.—The first and last weeks were fine and sunny, but in the intermediate period R or S fell on practically every day in small quantities, with much high wind. The temp. was for the most part somewhat below the normal, but the mean for the month was 42°3, or 0°·2 above the average. Duration of sunshine 99·4 * hours, and of R 43·5 hours.

Crowborough.—Variable till 18th and mild on the whole, but wintry weather on 19th with night frosts and continual light S. The month closed calm and mild. Mean temp. 38°·1, or 2°·4 below the average, and 5°·2 below that of March, 1905. R ·05 in. above the average.

Blakeney.—On 12th, with a heavy N.E. to N.W. gale, occurred the highest tide since November, 1897. No damage was done here, but at Cley many houses were inundated.

Torquay.—Mean temp. 44°·2, or 0°·1 above the average. Duration of sunshine 148·3* hours, or 9·1 hours above the average, Mean amount of ozone 5·7.

North Cadbury.—Judging by means, a normal March, but in fact most abnormal. Till 18th it was unusually warm, with S.W. wind and R. From 19th to 29th was the coldest period of the whole winter, with N. and N.E. winds and frequent S, but plenty of sunshine.

Clifton.—The first week was fine, then R or S fell every day till 16th. The remainder was mostly dry, with slight frosts and keen N.E. winds. R ·37 in. above the average.

Bolton.—Bright and sunny, the duration of sunshine being 93·7* hours, or 17·6 hours above the average. Cold N. and E. winds prevailed.

Carmarthen.—The first three weeks were wet and cold, with some H, sleet and S, hindering work on farms and gardens. The latter part was exceptionally cold and dry, with bitter N. and N.E. winds.

Gogerddan.—From 1st to 15th was rough and boisterous from W. and N.W., the wind amounting to strong gales at times with R. Cold drying E. and N.E. winds and strong sunshine from 15th to the end.

Douglas.—Very stormy and colder than either January or February, with falls of S and H and slight frosts. A series of strong N.E. and N.W. winds set in on 11th and prevailed throughout the remainder of the month, causing extremely cold weather.

Dumfries.—The low temp. and biting E. winds of the latter half greatly checked vegetation, but a better time for sowing the corn crop has hardly ever been experienced.

Riddell.—A typical March; it "came in like a lion and went out like a lamb." There was much N. wind, gales, R and S, and everything was disagreeable till the last four days.

Inveraray.—There was an extraordinary fall of 2·90 in. of R on 16th, but it appears to have been local.

Coupar Angus.—Cold after the first week, with N. winds and S, which drifted in places, blocking the roads. R ·90 in. below the average.

Drumnadrochit.—The coldest and stormiest of the winter months. There was considerable flooding from melting S. R ·51 in., and rainy days 6, above the average of 20 years. Aurora borealis on 24th.

Dunmanway.—The traditional March; cold and dry, with much N.E. wind and bright sunshine.

Cork.—R less than half the average. The mean temp. of the first 18 days was 44°·8 and of the last 13, 39°·6.

Darrynane Abbey.—The first half was mild and wet, the second dry and cold, except the last three days. R 70 per cent. of the average.

Omagh.—The first fortnight was raw and very wet, with frequent H, sleet and S showers, and some sharp night frosts, but the latter part was made up of typical March weather, with strong N.E. winds drying the ground and enabling a large breadth of cereal crops to be sown in excellent order.

* Campbell-Stokes.

Climatological Table for the British Empire, October, 1905.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	61·0	9	27·8	22	53·8	38·7	40·9	85	97·9	23·7	1·40	14	5·9
Malta	82·5	6	56·9	21	73·3	62·2	59·2	80	132·6	51·7	2·94	11	4·7
Lagos	87·0	13*a*	69·0	16	83·9	73·9	73·9	81	144·0	63·0	5·99	17	7·7
Cape Town	86·8	31	47·1	8	67·5	52·9	52·5	74	...	...	1·42	12	5·1
Durban, Natal	86·9	19	49·5	2	77·2	61·8	...	...	143·3	...	3·87	14	5·7
Johannesburg	87·8	18	35·7	1	78·4	53·8	43·4	49	164·0	33·5	·85	4	1·5
Mauritius	85·1	28	59·1	4	81·5	65·5	63·2	72	150·0	51·2	1·99	18	5·4
Calcutta	90·9	4	68·9	30	87·4	74·9	74·0	81	157·0	63·8	4·78	7	4·8
Bombay	94·7	8	74·9	30	89·7	78·1	75·2	77	141·0	68·0	·20	5	3·6
Madras	93·7	28	66·7	28	88·6	74·9	74·7	84	145·2	62·2	19·65	15	5·3
Kodaikanal	69·0	1	46·4	30	63·4	51·4	48·1	73	143·9	32·6	15·36	18	5·3
Colombo, Ceylon	87·7	5*b*	72·4	10	85·5	75·1	74·4	86	149·8	71·4	14·81	19	6·1
Hongkong	85·7	19	59·7	21	80·4	72·0	66·3	71	147·1	...	1·83	4	4·9
Melbourne	72·0	10*c*	36·0	8	59·9	45·5	43·4	77	135·1	28·4	2·57	16	6·9
Adelaide	77·0	5	38·9	20	64·3	46·1	44·0	67	139·0	32·4	2·90	18	5·8
Coolgardie	89·6	20	39·0	11	73·2	47·2	40·4	48	152·0	35·2	·61	5	3·7
Sydney	84·7	6	44·1	9	67·2	50·8	46·8	64	123·8	32·7	2·31	26	5·1
Wellington	64·0	24	41·3	15	59·0	48·3	46·0	76	126·0	36·0	6·17	18	7·0
Auckland	66·5	30	44·0	15	60·8	49·9	48·7	79	136·0	38·0	5·87	21	5·8
Jamaica, Negril Point	89·9	24	70·9	18	86·9	73·3	74·6	81	...	...	11·14	10	...
Trinidad	91·0	4	70·0	sev.	88·6	71·7	74·0	82	169·0	67·0	6·94	17	...
Grenada	88·0	7	72·0	20	84·9	75·3	72·7	77	150·0	...	8·73	19	4·4
Toronto	78·0	1	25·2	29	57·4	40·2	43·6	79	97·0	17·5	3·49	10	5·3
Fredericton	72·8	2	16·1	27	55·0	32·2	31·4	55	...	...	·86		3·7
Winnipeg	78·0	8	6·0	24	48·0	28·1	...	...	...	...	1·03	7	5·6
Victoria, B.C.	58·0	5	33·5	19	52·9	42·6	...	82	...	...	2·81	14	5·9
Dawson	48·5	5	−2·8	29	30·2	18·5	...	...	...	...	1·84	14	7·1

a and 30. *b* and 29, 30. *c* and 16.

MALTA.—Mean temp. of air 66°·4, or 2°·9 below average. Mean temp. of sea 73°·0; hourly velocity of wind 10·7, or 1·9 miles above average.

Mauritius.—Mean temp. of air 0°·7, of dew point 1°·4, and R ·41 in. above averages. Mean hourly velocity of wind 9·3 miles, or 1·7 miles below average.

MADRAS.—Bright sunshine 180·5 hours.

KODAIKANAL.—Bright sunshine 167 hours.

COLOMBO.—Mean temp. of air 79°·9, or 0°·3 below, of dew point 1°·4 above, and R ·14 in. above, averages. Mean hourly velocity of wind 6·5 miles, prevailing direction, S.W.

HONGKONG.—Mean temp. of air 75°·9. Mean direction of wind E. by N., and mean hourly velocity 12·4 miles. Bright sunshine 201·7 hours. R 2·90 in. below 20 years' average.

Adelaide.—Mean temp. of air 6°·9 below, R 1·17 in. above, average. Bright sunshine 49 hours below average.

Sydney.—R ·65 in. below, mean temp. 4°·4, and humidity 4·9 below, averages.

Wellington.—Mean temp. of air 0°·8 below, and R 1·90 in. above, averages.

Auckland.—Stormy month, R 2·75 in. above average. Mean temp. much below average

Trinidad.— R 6·94, or ·17 in. above 40 years average.

Symons's
Meteorological Magazine.

No. 484. MAY, 1906. Vol. XLI.

THE RAINFALL OF APRIL AND OF THE FIRST FOUR MONTHS OF 1906.

April has been an unusually dry month over the greater part of the British Isles, and a large part of southern England experienced an absolute drought, continued from March, throughout the first fortnight. The variations of rainfall over the country for the month just past, and for the four completed months of 1906 in the aggregate, are amply set forth in the Table on pp. 76-77, and only a few words are required to direct attention to the facts there recorded. As frequently happens in the distribution of rainfall, the north-western part of our islands was subjected to a set of conditions sharply in contrast with those experienced in the south-east. Everywhere to the north of a line drawn from Sligo Bay to a point in the middle of the south shore of the Moray Firth the rainfall of April was above the average. The general rainfall for the month in this wet area had an excess, as nearly as we can estimate it, of 28 per cent., not making it a very wet month it is true, but at least keeping April in harmony with the three months which went before in that part of the country. Over England and the south-east of Scotland and Ireland, where the deficiency of rain declared itself, the general rainfall showed a deficiency of about 43 per cent. There was a large part of England and the south of Scotland over which rather less than half the average amount of rain fell, the driest area extending from Dundee to Chichester and Torquay, on the whole filling the eastern and central parts of the island, although all along the east coast itself there was a slightly higher fall, such as might be expected from the prevalence of wind with an easterly component.

Turning from the relation of rainfall to the average to the actual amounts which fell, we find a remarkable number of returns recording less than one inch for the month. Indeed, from the shores of the North Sea to the borders of Wales, falls of one inch or more only occurred on some isolated patches of high land or in the continuation of the Pennine Chain, and falls exceeding two inches were recorded in only half a dozen isolated patches in what are normally the wettest parts of England and Wales. Fairly heavy falls, however, took place in the north-west of Scotland.

While April has proved a dry month in most places, the fact remains that so far as 1906 has gone it still deserves to be accounted a wet year. The distribution of rainfall has varied each month, no less than the amount. A triangular strip which has missed most of the heavy falls, lies with its apex in the north-east of Ireland and widening across Scotland and England until its base borders the North Sea from Aberdeen to Hull; over this area the average has not been reached, the mean deficiency being 17 per cent. The extreme south of Ireland also seems to have received a little less than the average rainfall; but all other parts of the British Isles show a considerable excess despite the dryness of the last month. The excess is greater than 25 per cent., and rises in places to 43 per cent., in five areas, *viz.*, the north-west of Ireland, the west and north of Scotland, Wales, the south-west of England, and Norfolk and Suffolk. From the general arrangement of the areas of excessive and deficient rainfall, the tendency towards the formation of parallel belts running from north-east to south-west, to which attention was called in our January number when dealing with the rainfall of 1905, seems to continue.

ABSOLUTE DROUGHT IN LONDON, MARCH-APRIL, 1906.

THE following letter appeared in *The Times* of April 30th :—

SIR,—The fall of nearly a quarter of an inch of rain in the early hours of this morning has broken a period of drought which, if neither very prolonged nor very serious, is by no means usual.

What constitutes a drought in popular language I do not know; but the indefiniteness of the expression and the exaggeration of the facts which resulted led, many years ago, to the formulation of two definitions, the usefulness of which is generally acknowledged. An absolute drought is taken as a period of more than 14 consecutive days on which no rain is recorded (the smallest figure recorded in any case being ·01 in.), and a partial drought is taken as a period of more than 28 consecutive days, the average rainfall of which does not exceed ·01 in. per day. In the 48 complete years' record at this station there have been 53 absolute and 47 partial droughts, so that both occur on the average about once a year.

Absolute droughts occur most often in April and June, partial droughts are most frequent in May and July. On the occasion just passed the absolute drought lasted for 17 days, not a drop of rain having fallen between March 27 and April 12, both inclusive. On Good Friday the skirts of one of the thunder-showers which swept over the country north of London touched this station, and in six minutes just ·01 in. of rain was recorded. But for this technical break the absolute drought would have lasted for 23 days, as it did in most parts of London in fact, and over the whole in effect. The

partial drought extended to 34 days from March 24 to April 26, both inclusive, the total rainfall in that period amounting to ·34 in.

The uncertainty of weather makes it a safe rule to call no month dry until it is ended; but it is at least probable that April will be much drier than March, which was much drier than February, which in turn was much drier than January. Put roughly to the nearest fifth of an inch, the rainfalls of the first three months of 1906 in London have been respectively 4 in., 2 in., 1 in.; and it is not yet impossible that the fourth month may continue this interesting arithmetical series and be expressible as half an inch.

Your obedient servant,

HUGH ROBERT MILL.

62, Camden Square, London, N.W., April 28.

[The words "arithmetical series" in the last sentence should have been "numerical series." Misled by the adjective, a critic, zealous of the exactitude of mathematical terminology, took the trouble to inform the public that the series quoted was not an "arithmetical progression" but a "geometrical progression," which is true; though in the letter it was not called a "progression."—ED., *S.M.M.*]

Correspondence.

To the Editor of Symons's Meteorological Magazine.

HEAVY FOUR MONTHS' RAINFALL IN CHESHIRE AND NORTHUMBERLAND.

I WAS interested in the recent letter in *The Times*, describing the arithmetical sequence of your London Rainfall. Ours in Cheshire has been very different. In 30 years we have never had such a record of heavy falls for the first third of a year:—

January	3·93 in.
February	3·28 in.
March	2·57 in.
April	2·29 in.
Four months	12·07 in.

Even 1882—which gave us 41·95 in. on the whole year—only gave 9·56 in. to 30th April; and till now no year has surpassed 1903 with its 10·19 in. for the first four months.

EDWARD PEARSON.

Parkside, Wilmslow, May 1st, 1906.

HAVING seen the letter in yesterday's *Times*, I may add that our experiences do not entirely agree with yours in London and many other places—*e.g.* :—

	Rainfall.	Heaviest fall.	Date.	No. of wet days.
January ...	1·88	·58	28th	18
February...	1·15	·28	25th	13
March	1·62	·42	11th	14
April	1·55	·41	16th	12

On Sunday last (29th) we had ·38 in., mostly snow, falling between 10·45 and 3 p.m. or thereabouts, whilst on the Saturday before we had nothing. In Newcastle, I hear, it was wet on Saturday and not on Sunday. The Cheviots were all white at midday on Sunday, and the snow was lying here on the low ground as well, but it worked off the lower ground before dusk; some snow had actually accumulated in the gauge and took some little time to melt. We had no absolute or partial drought, the nearest approach being between March 25th and April 16th, 21 days, both inclusive, when we had only one small shower, ·04 in. on the 7th April; we also had ·32 in. mingled snow and rain on April 25th. I do not think I ever before experienced such a day as Sunday last so late in the season as the end of April, nor such a bitter April.

B. P. SELBY.

Pawston, Mindrum, Northumberland, May 1st, 1906.

APRIL WEATHER.

THE weather of April, 1906, in this district has been remarkable for some extraordinary vagaries.

The first 17 days of the month were rainless, with the exception of the 5th, when rain fell continuously from 6 p.m. to midnight, depositing ·25 in. in the gauge. The remainder of the precipitation for the month, which chiefly occurred in the last week, amounted to 1·17 in., and brought the total to 1·42 in.

The 30th was remarkable for a hailstorm, lasting from noon to 0·30 p.m., which deposited ·38 in. of rainfall in the gauge. This amount probably failed to represent the total precipitation, as the hail being about the size of peas and very hard, no doubt to some extent bounced out of the funnel of the gauge. The hail lay on the ground to a depth of over an inch. The temperature fell in the half hour whilst the storm was in progress to the extent of 12°. Just before the storm, the dry bulb stood at 55° and the wet bulb at 50°. Directly it was over, the thermometers were again read and they were 43° and 41° respectively. The barometer, which had been quite steady for two days previously, gave the usual sudden upward movement generally noticed before thunderstorms, but no electrical phenomena were observed here.

Some low temperatures were observed in the latter part of April, which must surely be unusual for the south coast.

Shade Minima.—April.

15th	31°	23rd	37°
16th	32°	24th	32°
17th	31°	26th	33°
19th	35°	27th	32°
20th	33°	29th	32°

It is not to any extremely low reading that I would call attention, but to the continued persistent cold.

D. W. HORNER.

Worthing, May 1st, 1906.

THE THUNDERSTORM OF MAY 8th.

YOU will find the area of the big rain of Tuesday evening, May 8th, a restricted one. It is the largest single fall we have had here since September, 1880; July, 1890; October, 1893.

The thunderstorm (which lasted six hours, 5.30 to 11.30) was a Thames Valley one, probably extending from Richmond to Reading.

At Upton, from west to east, the readings run:—

	in.	
Mr. Warren.....	1·91	
Mr. Bentley.....	1·96	westerly gauge.
do.	2·03	easterly gauge.

At Windsor rain was very heavy. Burnham and Farnham (say 4 miles north of this) report none. Bray reported rain. Maidenhead, I think, none or not until late.

RICHARD BENTLEY.

Upton, Slough, Bucks, May 10th, 1906.

As the amount of rain which fell during Tuesday's thunderstorm seems to have been very variable round about London, I send you the amount that fell here—1·08 in. All of this fell between 6.35 p.m. and 7.7 p.m., a period of 32 minutes. The hailstones were large, but there were not many of them, so that I do not think the gauge lost much by out-splashing.

ERIC L. HAWKE.

10, Frognal, Hampstead, N.W., May 10th, 1906.

[The rain recorded at Mill Hill was ·09 in., that at Camden Square only ·01 in.—ED. *S.M.M.*]

SNOW ON THE HILL-SIDES.

I HAVE been much interested in the correspondence on this subject. May I be allowed to say a few words on a similar matter? It is my

fortune to reside on the southern borders of the English Lake District. The hills of this immediate neighbourhood are spurs of the great mountain masses lying further north; other spurs run down towards the sea in more or less parallel ridges, somewhat irregular in height, but all trending generally in a direction from N.N.E. to S.S.W., with valleys of varying width lying between them. Our geological formation is all of the Silurian period, being of slaty material. Some of the hills are of volcanic origin, others due to aqueous agency. For some years I resided on the westerly slope of one of these ridges, opposite to the easterly slope of another ridge, with a valley a mile or more wide intervening. During snowy periods I noted that if the fall was not great—say an inch or two was lying in the morning—by noon or soon after, if the day were sunny scarce a trace of the snow would be left on the slope opposite, while on our side very little difference in the depth of the snow could be seen, and it would often be a day or two longer before it was gone. The explanation being, as it appeared to me, simply that the easterly slope receiving all the morning sunshine and with the sun's rays acting perpendicularly, or nearly so, on it—while the westerly slope receiving scarcely any sunshine at all and that only acting at a very low angle—the snow was bound to disappear more rapidly on one side than on the other, the afternoon sun being not of much account in the winter time. If also we remember that for the same reason the soil of the easterly slope will in all probability be much warmer than that of the westerly slope, we can scarcely think the matter could be otherwise. Another little fact in this connection may also be noted—one, perhaps, that is sometimes lost sight of—viz., the *distribution* of the snowfall on these hill-sides. This varies considerably with the direction of the wind, for if the wind be blowing rather strongly and steadily in one direction during the snow-storm, the hill slopes facing the wind will have a much heavier deposit of snow than will be found on their lee sides. A specially striking example of this occurred during the present month. On the 17th inst. a stormy wind was blowing from the W.S.W. with some rather heavy showers of rain in this immediate locality but heavy snow-storms up among the hills. The following morning I set off with a friend for a walking tour among these hills and valleys. On starting we had immediately in front of us the S.W. side of Coniston Old Man and his fellows and these were all covered with a sheet of snow, but as we proceeded on our way and got to the southern and south-eastern side we found the snow gradually thinned away, till further up on the E.N.E. sides there was absolutely no snow at all on them. We stood on some high ground to the N. of the little town of Hawkeshead and a grand sight presented itself. The whole range of mountains to the N.E.—High Street, Ill Bell, Kidsty Pike and the rest—were absolutely white with snow, but turning round and looking in the opposite direction no snow at all was to be seen, just the dark purple rocks and the masses of

golden brown bracken lying amongst them; whilst looking due N. or somewhat to the N.W. one side of the mountains could be seen covered with snow, the other side with none at all.

C. P. CHAMBERS.

April 28th, 1906.

THE CYCLONIC STUDY OF RAINFALL.

PERMIT me to thank you for the abstract you give in *Symons's Meteorological Magazine* of my paper on the distribution of precipitation in some American cyclones. Thinking that you might wish to know about those points which I neglected mentioning, I take the liberty of saying that the limit of precipitation I used was that of perceptibility, and that I used all cyclones, large and small, unless there was doubt as to whether the stations averaged were to be referred as being within their gradient or it was clear they were not to be so referred. For example: if there was one cyclone to the west of a station 800 miles from this, and another east 900 miles distant, then the data were averaged in that cyclone of these two, inside of which the station lay. If the "high" separating these two "lows" lay to the west of the station, then the east cyclone was used—or vice versa.

The crescent-shaped distribution of precipitation in the western cyclones I averaged, suggest that your opinion may be right as to the proper way of orienting the diagram with regard to the path of the cyclones. Should these crescents change to a more or less circular area, if the diagram were oriented in that way, it would be pretty strong evidence that yours would be the proper way. I wish I could try this, but I can hardly hope to take the necessary time for it.

I hope others will see the many applications the method is adapted to in obtaining a more exact knowledge of the cyclone. Perhaps the distribution of the rainfall may yet be such as our text-books would have it: the maximum being to the south-east. If so, then there must be a diurnal rotation of the area of greatest precipitation, for it is certainly not in that quarter for the morning hour.

J. A. UDDEN.

Rock Island, Ills., April 9th, 1906.

THE GREEN FLASH.

IT should be noted that the green or any other coloured ray is not always seen even when the sun sets at sea on a perfectly clear horizon.

D. WILSON-BARKER.

H.M.S. Worcester, off Greenhithe, Kent, May 5th, 1906.

THE GREEN FLASH IN FICTION.

DR. RAMBAUT'S able articles on the Green Flash on the Horizon must have reminded many readers of the periodical recurrence of interest in this curiously fascinating phenomenon. It is by no means easily seen, for the opportunity of a clear evening and an unobstructed sea-horizon occurs but rarely to the average man. We have seen it only a dozen times in twenty years, though these years afforded many thousand miles of ocean travel. We saw it twice in the Baltic, once in the North Atlantic, once off the west coast of Scotland, twice in the Bay of Biscay, and four or five times in the Indian Ocean, on one occasion on a land horizon rising a few minutes of arc above the sea. The gradual change from a yellowish to a bluish green was apparent on most of these occasions.

In the early eighties M. Jules Verne made the phenomenon the text of a novel, "*Le Rayon Vert*," (The Green Ray), and it seems not without interest to recall this instance, solitary, so far as we know, of a meteorological phenomenon inspiring a work of creative fancy. The book is peculiar in more ways than one. It partakes of the nature of a guide-book to a tour on the west coast of Scotland and abounds in delightful touches, showing how difficult it is for a stranger to appreciate the full value of local colour.

The story is simple. Two old gentlemen, who in many ways are charmingly simple also, live at Helensburgh with their niece, Helena Campbell, to whom they are devoted, and they have decided that it would be a delightful arrangement for Helena to marry a young scientific man rejoicing in the typical Scottish name of Aristobulus Ursiclos. They broach the subject to the young lady, who laughingly declares that she will make up her mind to marry no one until she has seen—the Green Ray. The uncles had never heard of such a thing, but the niece (at 5 p.m. in Helensburgh, in 1881,) produces the *Morning Post* of that day with this article, which in default of turning up the paper in question we re-translate from the French :—

"Have you ever observed the sun when it is setting beneath a sea-horizon? Yes! without doubt. Have you followed it to the moment when, the upper part of the disk just touching the line of water, it is in the act of disappearing? It is very probable that you have. But have you noticed the phenomenon which appears at the precise moment when the radiant orb shoots forth its last ray if the sky is free from haze and perfect in its purity? Perhaps not. Ah! well, the first time you find the occasion to make this observation—and it presents itself but rarely—it will not be a red ray that will strike your eye, as one might expect; it will be a "green" ray, but a marvellous green, a green that no painter could obtain on his palette, a green of which even Nature itself has never reproduced the shade, neither in the varied tints of vegetation nor in the colours of the most limpid seas! If there is a green in Paradise it can only be that green, which is, without doubt, the very green of Hope!"

The niece, however, did not say, though apparently she knew, that an old Highland legend affirmed that this ray conferred on whoever saw it the magic power of making it impossible to deceive oneself in matters of sentiment, by destroying all illusions and lies, and of seeing clearly into one's own heart and into the hearts of others. If any members of the Society for Psychical Research accompanied the British Association on its African cruise, they might perhaps supplement the physical treatise by developing this attractive thesis. The uncles merely responded, "Let us go and see the green ray"; and next morning they left Helensburgh and betook themselves *via* Crinan to Oban, a route which the uncles did not like. "Au diable ce Rayon-Vert!" said one, "And those who invented it," replied the other; but they went. At Crinan they heard Gaelic spoken, "a language often incomprehensible even to the English." That night the sun set in a cloudless sky, but the steamer at the moment was performing heroic evolutions in the Gulf of Corryvreckan rescuing a small boat which had got caught in the whirlpool, and all eyes were turned on the handsome young man who was rescued at the moment the sun went down. It was Olivier Sinclair, who prevented the sight from being seen: an artist, a poet, a traveller whose sketches of foreign travel were accepted even by the famous *Edinburgh Review*. At Oban Aristobulus Ursiclos joined the party. He brought the melancholy news that "the depression of Swinemunde was moving northwards and deepening considerably. Its centre was at Stockholm to-day and there the barometer had fallen one inch, or, to employ the decimal system used by men of science, twenty-five millimeters." Consequently, the fine weather was not to last. Moreover, at Oban there was no sea-horizon, and excursions had to be made each evening to a neighbouring island to see the sun set. After a fortnight's waiting, an evening arrived when the sun had half set on an absolutely clear horizon but a sailing-boat glided up and blotted out the critical moment of total immersion. Aristobulus Ursiclos was on board.

The party proceeded to Iona, and in waiting for a clear sky Ursiclos announced his intention of writing a memoir on the green ray, which he held derived its colour either from the sea-water or from the contrast with the red of the sun. Olivier Sinclair recommended him also to prepare memoirs on two other important oceanographical and meteorological problems, to wit, "On the influence of the tails of fishes on the waves of the sea," and "On the influence of musical instruments on the formation of storms." Again a clear evening came, and as the last little segment of the solar disk was on the point of vanishing, bang went two shots and a cloud of frightened sea-birds rose like a veil blotting out the view. Aristobulus Ursiclos had fired the shots.

This was too much even for the uncles, who instantly hired a charming yawl and all the good characters set sail for Staffa, marooning the mephistophelian Aristobulus on Iona. At length,

after amazing adventures in Fingal's Cave during a storm, another cloudless evening was about to pass into night; the uncles, the niece, Olivier Sinclair, Partridge, the gillie, and Betsy, the maid, were all assembled. The sun dipped. "The green ray! the green ray!" cried the uncles, Partridge and Betsy in one voice . . . . . but Helena had only seen the black ray from Olivier's eyes, and Olivier had only seen the blue ray from Helena's, and they all lived happy ever after! Olivier ultimately painted a magnificent picture of the green ray he had never seen.

Such is the gist of 270 very entertaining pages.

Although it is not fiction, we may quote here a question set recently in the examination in Astronomy for the Science degree of the University of which Aristobulus Ursiclos is alleged to have been a distinguished graduate. It runs:—

Being given that the last red ray from the sun disappears when its centre is at a distance a below the horizon, but that if the horizon be clear the blue rays may remain visible until it has sunk to a distance $a+da$, where da is a small quantity whose square may be neglected, show that in latitude $\frac{\pi}{2}-\omega-a-da$ (where ω is the obliquity of the ecliptic) on the night of the summer solstice the blue rays may persist after the red have disappeared for a time h given by the expression

$$2\sin^2\frac{h}{2}=\frac{\cos a\,da}{\cos\omega\sin(\omega+a)}$$

DR. W. N. SHAW ON ATMOSPHERIC CIRCULATION.

On May 1st, at the University of London, Dr. W. N. Shaw delivered the first of his series of four lectures on Meteorology, dealing mainly with the broader features of the general circulation of the atmosphere. By way of introduction he pointed out that a period of stagnation seemed to have followed the rapid development of the cyclonic theory as the basis of weather forecasting, and that the processes now in use differed little from those of a quarter of a century ago. In other directions, however, the progress of meteorological study has been great. The investigator of to-day has not as formerly to work on a more or less conjectural or speculative basis, since during the last 50 years a wealth of observational matter has been gradually and patiently accumulated, and now lies ready to the hand of the student. It is, therefore, possible and most desirable that the subject should be attacked afresh from the wider point of view.

Turning to the immediate subject of the lecture, it was remarked that the circulation of the atmosphere must be looked upon as a single, though complicated, process taking place over the globe as a whole. Discussion confined to any portion of the Earth, as for instance the British Isles, would, therefore, be inadequate.

Owing to the thinness of the atmospheric layer in comparison with the area over which it is spread, the intensity of the horizontal movement is far greater than that of the vertical, and this horizontal action is brought about by a variety of influences. Primarily, disturbances of thermal equilibrium cause disturbances of dynamic equilibrium, and thus the movements of the atmosphere may be looked upon as due to the variable distribution of heat. Such disturbing influences are the movements of the sun, the irregular distribution of land and water, the heat liberated by the condensation of water vapour, actual alterations in the heat of the sun itself, and above all the rotation of the Earth. There are, however, recognisable underlying regularities which are not entirely obscured.

The phenomenon of the diurnal variation of the barometer was excellently illustrated by slides showing a series of barograms produced on board H.M.S. *Leander*, in various parts of the globe, and it was observed that though this was frequently obscured in temperate regions, by analysing the average values from a number of curves, it could be shown that there existed a component oscillation with double maxima at 10 a.m. and 10 p.m., and the corresponding minima at 4 a.m. and 4 p.m., local time, all over the Earth.

Maps of prevailing winds give a good general impresslon of the surface circulation of the air, and Dr. Shaw was able to show that the circulation to be inferred from the mean isobars, by the application of Buys Ballot's law, corresponds very satisfactorily with the observed winds. Maps of average pressure, therefore, form the basis of all considerations as to surface conditions.

Another aspect of Buys Ballot's law may be called the numerical aspect. The actual movement of air compared with the disposition of force due to barometric gradient shows that the movement takes place nearly at right angles to the direction of the applied force, namely, nearly parallel to the isobars, with some incurving towards the centres of depressions, and some outcurving away from the centres of anti-cyclonic systems. The maintenance of a state of motion at right angles to the direction of the acting force is familiar to us in various cases of rotation, and in the case of the wind it can be accounted for by the rotation of the Earth. Motion in the revolving Earth without any pressure difference would imply acceleration to the right (in the Northern hemisphere), and thus to keep air moving steadily it requires pressure always to push it towards the left and counteract the effect of the Earth's rotation. It is possible, being given the latitude, to calculate from the velocity of the wind what gradient would be necessary in order to keep air moving along an isobar; or, in other words, to analyse the conditions under which air currents are guided in any particular direction. Several interesting slides were exhibited, showing the distribution of pressure and the calculated paths of air on February 10th-11th, 1899, and from June 13th-20th, 1883.

With regard to the movements of the upper air, one method of

studying them is by observing the movements of dust on such occasions as the great Krakatoa eruption of 1883, and a second by observations of the upper clouds. A number of slides were shown with graphic representations of the average direction of movements of the upper clouds at various stations in India and Europe, and Dr. Shaw went on to say that it is possible to calculate the distribution of the upper air from the known pressure at the surface, by deducting the weight of the lower strata, deduced from pressure, temperature and humidity observations. This was done some years ago by M. Teisserenc de Bort, who drew a map of the pressure distribution at 4000 metres altitude. The results accord well with those deduced from cloud observations.

Several photographs of kites and balloons for investigation of the upper air were also exhibited.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, April 18th, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. Alfred Hands read a paper on "Some so-called Vagaries of Lightning reproduced experimentally." He said that lightning is an electric discharge, and as such it should act in accordance with the laws that are known to govern discharges. We have, doubtless, much to learn yet as regards electricity, but even though fresh facts and laws may be discovered they can scarcely be in direct opposition to those already known, and, therefore, if an occurrence does not appear to accord with our knowledge, we should try and fathom the mystery and not dismiss it as a vagary. The author, in the course of an extended investigation into the effects of lightning, has come across many cases that have been called vagaries, but which on a close inspection have proved to be extraordinary only in the erroneous way in which they were described, and had they been correctly reported would have appeared perfectly consistent with ideas previously held—in fact, could have been foretold in every case if the conditions that led to those effects had been known before the events occurred.

Mr. Hands reproduced, experimentally, several so-called vagaries of lightning, showing by means of skeleton models the conditions under which they occurred, and by a single discharge producing effects which would be most perplexing if the arrangement of the hidden links in the alternative paths of conduction were not known.

Mr. Baldwin Latham said that he had frequently heard of lightning flashes making their way down chimney stacks, passing through the engine house, and thence seeking the earth, instead of taking a direct path from the top of the chimney shaft to the earth. He thought it would be desirable for those wishing to put up lightning

conductors to seek the best possible advice, so as to avoid the mistakes to which attention had been drawn in the paper.

Mr. J. E. Clark referred to a lightning flash that had fused a gas pipe in a narrow alley close to York Minster.

Mr. W. Marriott said that the Royal Meteorological Society had instituted a number of investigations on the subject, and had been the means of organizing the Lightning Rod Conference in 1878. The recommendations of that Conference for the protection of buildings from lightning still held good.

Mr. A. Hands said that a good earth connection for the lightning conductor was very necessary, but it was not everything, and care should be taken that rival conductors in the form of gas and water pipes were not set up and the discharge divided.

The President remarked that the early Egyptians took precautions to guard against damage by lightning, and the roof of Solomon's Temple was studded with metal points for the same purpose.

Miss C. O. Stevens read a paper on "The Value of a projected image of the Sun for Meteorological Study." She pointed out that by this method it had been ascertained that where the direction of movement of the atmosphere is tangential to the limit of the sun, the phenomenon of "boiling" displays a coursing or rippling character, and that where it is perpendicular to the limb of the sun the character of the movements of distortion is that of springing in and out of the area of the sun's image. Both these elements of movement are continuous, even in the absence of all visible cloud, and it is possible not only to detect but also to distinguish between overlying invisible atmospheric strata.

Mr. R. Inwards, Mr. W. H. Dines, Mr. H. Mellish, Mr. J. E. Clark, and the President, took part in the discussion on the paper, and Miss Stevens replied.

The following were elected Fellows of the Society :—Mr. K. N. Banaji, Mr. R. Cross, Miss E. Halsey, Mr. L. M. Ting, and Rev. F. W. Walter.

REVIEWS.

Report of the Meteorological Council for the Year ending 31st of March, 1905, to the President and Council of the Royal Society. Presented to both Houses of Parliament by Command of His Majesty. London: 1906. Printed for His Majesty's Stationery Office. [Cd. 2829]. Size 9½ × 6. Pp. 228. Price 1s. 5d.

THE last report of the anomalous body which controlled the Weather Service of the United Kingdom up to March 31st, 1905, has appeared rather more than a year after the Council in question has been superseded. The judgment passed upon the organization of the Meteorological Council by the Treasury Committee which sat upon it in 1902 and suggested various measures of reconstruction which have now in part been given effect to, will be remembered by our readers. Fortunately the men who carried on the work of the

Meteorological Office have always been better than the system under which they acted, and this has never been more true than in the last year of the old order of things.

The usual report of work done requires no special comment except that more time has been devoted to the purely scientific aspects of meteorology in the direction of experiment and special observations than in earlier years. The most interesting section of the Report is Appendix II., entitled "An account of the work of the Meteorological Office during the past fifty years." This is the official history of the relations of the British Government with meteorology. In 1855 the Government established a department of the Board of Trade under the charge of Admiral FitzRoy to co-operate in the international study of the meteorology of the oceans initiated by Lieutenant Maury of the United States Navy. The Government grant for this work (partly included in the Board of Trade, partly in the Admiralty votes) amounted to £4200. Co-operation with Kew Observatory in testing instruments was carried out from the first. In 1860, telegraphic weather reports were instituted by Admiral FitzRoy and storm warnings based upon them were issued. Weather forecasts also were prepared and published in the newspapers; but this work, which came to absorb most of the grant, it must be borne in mind, was superimposed upon the original functions of the Meteorological Office, which were international and world-wide. Admiral FitzRoy died in 1865, and a Committee of the Royal Society was appointed to inquire into the whole matter of the work of the Office. This Committee advised the stoppage of weather forecasts, the improvement of storm warnings, the continuation of marine observations for a time, and above all the establishment of "a full, constant and accurate system of showing changes of weather in the British Isles." As a result of this, a grant of £10,000 per annum was secured and the Royal Society appointed a Committee to administer the grant. The Committee, which included gentlemen well known in several walks of science, some of whom had paid special attention to meteorology, appointed Mr. R. H. Scott as Director of the Office, Captain Toynbee as Marine Superintendent, and Mr. Balfour Stewart as Secretary and Director of the Kew Observatory. Under this Committee the land meteorology of the British Isles was greatly extended and the system of daily weather charts and forecasts elaborated. This order of things terminated with the Report of the Treasury Committee of 1874 (*see* this Magazine, Vol. **12** (1877), pp. 17, 33, 97, for much interesting matter supplemental to the official narrative under notice), and the institution of the Meteorological Council of the Royal Society, a body whose constitution has been fully discussed in these pages (*see* this Magazine, Vol. **39** (1904), p. 102).

The funds at the disposal of the Council were increased, and under the chairmanship of Professor Henry Smith and then of Sir Richard Strachey and the secretaryship of Dr. R. H. Scott and later of Dr. W. N. Shaw, the Council proceeded to do much valuable work,

the main outlines of which are sketched in this history. The Weekly Weather Report was one of the first results of this reorganization and one which has proved singularly successful. The variation in the number of First Order Stations, or completely equipped meteorological obeservatories, is duly noted, and the fact that the Council yielded to external pressure and revoked the death sentence on Falmouth Observatory makes one regret that a little more pressure was not applied in the case of Fort William. The record altogether is one of solid, steady and increasing work, and we look forward with confidence to the new organization, which has been in force for more than a year, showing still greater progress. There are several matters waiting for reform in the future ; amongst others, the hardship which the more experienced members of the staff labour under in the absence of any proper system of pensions, or of reasonable prospects of promotion to the higher posts.

Modern Lightning Conductors. An illustrated supplement to the Report of the Lightning Research Committee of 1905, with notes as to the Methods of Protection and Specifications. By KILLINGWORTH HEDGES. London: Crosby, Lockwood & Son, 1905. Size 10 × 6. Pp. viii. + 120.

WE have not been so fortunate as to see the Report of the Lightning Research Committee, of which Mr. Hedges was the honorary secretary, nor does the present volume state where that Report may be obtained. The Committee was organised jointly by the Royal Institution of British Architects and the Surveyors' Institution, so that its objects were of a thoroughly practical nature, and the subject is certainly one well deserving of attention. It is probably our ignorance of the Report that makes Mr. Hedges's book appear to us to be confused in its arrangement and difficult to follow in its conclusions. It is sometimes hard to tell whether the author is giving the opinions of the Committee or his own comments upon them, and some of the chapters read like a random pile of newspaper cuttings bearing on lightning in fact and fancy. The letter-press would be improved by revision, and some of the historical statements might be verified. We did not know, for instance, that Benjamin Franklin had been knighted (p. 105).

Chapter III. gives a summary of the suggestions and recommendations of the Lightning Research Committee, and so far as these differ from the findings of the Lightning Rod Conference arranged by the Royal Meteorological Society in 1878 they are likely to prove disquieting to those responsible for the protection of buildings. The instances quoted by the author of serious damage caused to "protected" buildings by lightning and the apparent scepticism of the Lightning Research Committee as to the possibility of securing complete protection, might almost induce some people to run the risk of having no lightning conductor at all rather than incur that of installing a possibly insufficient system.

TEMPERATURE FOR APRIL, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32° Shade.	Grass.
		° ′	° ′							
Camden Square	*London*	51 32	0 8	111	73·0	12	30·1	15 †	5	17
Tenterden	*Kent*	51 4	*0 41	190	72·5	11	28·0	24	9	16
West Dean	*Hampshire*	...	...	137	67·0	12	24·0	16	13	28
Hartley Wintney	,,	51 18	0 53	222	73·0	12	24·0	15, 16	9	16
Hitchin	*Hertfordshire*	51 57	0 17	238	70·0	11, 12	26·0	14	14	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	72·0	12	25·0	20	9	21
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	73·0	11	27·0	20	14	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	64·8	12	25·0	14, 24	10	17
Torquay (Cary Green)	*Devon*	50 28	3 32	12	64·8	13	33·9	3	0	11
Polapit Tamar [Launceston]	,,	50 40	4 22	315	66·9	11	26·9	16	10	12
Bath	*Somerset*	51 23	2 21	67	68·5	12	26·0	27	7	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	66·0	13	32·0	30	1	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	69·5	13	23·0	19	17	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	68·0	12	22·0	14, 26	12	...
Boston	*Lincolnshire*	52 58	0 1	25	70·0	12	26·0	20	12	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	70·1	13	23·5	10	17	27
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	73·0	11	29·0	14, 26	9	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	63·6	12	29·5	27	4	16
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	69·0	13	29·0	3 ‡	11	24
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	69·3	11	30·1	18	5	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	67·6	12	26·7	16	6	21
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	71·0	12	21·0	18	19	...
Llandudno	*Carnarvon*	53 20	3 50	72	62·0	4	32·5	27	0	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	69·0	12	27·0	3, 19	10	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	65·0	12	23·0	2	20	27
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	65·8	10	28·5	19	4	16
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	63·0	12	23·0	18	14	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	67·0	11	27·0	18	10	27
Tighnabruaich	*Argyll*	55 55	5 14	50	56·0	7	28·0	18	17	19
Mull (Quinish)	,,	56 36	6 13	35	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	63·2	13	27·0	19	13	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	61·0	9, 10	25·0	23, 29	18	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	7
Dunrobin Castle	*Sutherland*	57 59	3 56	14	60·0	9	29·5	24	...	22
Castletown	*Caithness*	58 35	3 23	100	64·0	12	29·0	17, 19	3	...
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	67·0	13	28·0	15, 19	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	63·0	11	29·0	15	7	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	63·0	12	28·0	13 §	12	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	63·5	12	32·0	19	1	16
Ballinasloe	*Galway*	53 20	8 15	160	65·5	11	22·0	3	20	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	63·0	12	30·0	9	7	18
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	66·0	10, 11	27·0	18	6	17

† and 20, 26. ‡ and 20, 25, 27. § and 17, 18

RAINFALL FOR APRIL, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
ver. 0-99. n.	1906. in.	Diff. from Av. in.	% of Av.	Max. in 24 hours. in.	Date.	No. of Days	Aver. 1870-99. in.	1906. in.	Diff. from Aver. in.	% of Av.	Mean Annual 1870-1899. in.	STATION.
·69	·51	—1·18	30	·22	27	10	6·82	7·50	+ ·68	110	25·16	Camden Square
·77	1·44	— ·33	81	·45	18	9	7·87	9·07	+1·20	115	28·36	Tenterden
·99	·98	—1·01	49	·38	5	7	8·73	11·53	+2·80	132	29·93	West Dean
·69	·64	—1·05	38	·15	27†	7	7·91	8·43	+ ·52	107	27·10	HartleyWintney
·62	·66	— ·96	41	·19	27	9	6·50	7·66	+1·16	118	24·66	Hitchin
·83	·84	— ·99	46	·21	13	10	7·23	7·90	+ ·67	109	26·75	Addington
·54	·85	— ·69	55	·24	27	13	6·43	9·00	+2·57	140	25·39	Westley
·68	·70	— ·98	42	·24	27	13	6·49	9·38	+2·89	145	25·40	Brundall
·60	1·14	—1·46	44	·43	24	8	12·02	15·74	+3·72	131	39·00	Winterbourne Stpltn
·45	·85	—1·60	35	·44	24	10	10·96	11·87	+ ·91	108	35·00	Torquay
·23	1·46	— ·77	65	·42	24	11	11·35	16·28	+4·93	143	38·85	Polapit Tamar
·05	1·24	— ·81	60	·30	24	11	8·63	9·28	+ ·65	108	30·75	Bath
·05	·81	—1·24	40	·16	5	11	8·50	8·86	+ ·36	104	29·85	Stroud
·14	1·27	— ·87	59	·32	29	12	9·23	9·48	+ ·25	103	33·04	Woolstaston
·66	1·09	— ·57	66	·35	26	11	6·56	6·96	+ ·40	106	24·50	Bromsgrove
·59	·58	—1·01	36	·30	27	7	6·09	7·24	+1·15	119	23·30	Boston
·69	·62	—1·07	37	·17	22	12	6·56	6·77	+ ·21	103	24·70	Hodsock Priory
·72	·60	—1·12	35	·22	23	10	6·82	7·96	+1·14	117	26·18	Derby
·15	2·43	...	...	·53	27	14	...	16·77	...	...	42·43	Bolton
·98	·66	—1·32	33	·20	22	8	7·35	8·19	+ ·84	111	26·96	Ribston Hall
·32	2·17	—1·15	65	·44	28	14	19·42	24·19	+4·77	124	60·96	Arncliffe Vic.
·72	·87	— ·85	51	·25	28	12	7·17	6·73	— ·44	94	27·02	Hull
·79	1·57	— ·22	88	·82	29	14	7·43	6·28	—1·15	85	27·99	Newcastle
·27	4·09	—2·18	65	1·01	27	14	43·13	42·74	— ·39	99	132·68	Seathwaite
·34	1·38	— ·96	59	·55	24	14	12·11	16·19	+4·08	134	42·81	Cardiff
·67	1·16	—1·51	43	·29	27	11	14·53	15·53	+1·00	107	47·88	Haverfordwest
·39	1·85	— ·54	77	·65	27	14	12·22	17·05	+4·83	140	45·41	Gogerddan
·82	1·10	— ·72	60	·28	27	10	8·33	11·07	+2·74	133	30·98	Llandudno
·30	1·04	—1·26	45	·46	21	9	13·47	10·90	—2·57	81	43·43	Cargen
·96	·92	—1·04	47	·32	21	13	9·37	6·94	—2·43	74	33·04	Riddell House
...	·81	...	...	·42	16	7	...	6·90	..	...	...	Edinburgh
·25	1·81	— ·44	80	·58	20	11	13·62	12·16	—1·46	89	44·85	Colmonell
·77	1·23	— ·54	70	·50	20	12	9·88	12·37	+2·49	125	35·80	Glasgow
·89	3·27	+ ·38	113	·47	27	17	17·68	22·01	+4·33	125	57·90	Tighnabruaich
·80	2·95	+ ·15	105	·40	27	20	17·38	17·09	— ·29	98	57·53	Quinish
·94	·95	— ·99	49	·45	16	9	8·06	4·75	—3·31	59	28·95	Dundee
·18	1·73	— ·45	79	...	...	...	10·21	11·19	+ ·98	110	36·07	Braemar
·22	1·55	— ·67	70	·50	16	10	9·40	7·84	—1·56	83	33·01	Aberdeen
·49	2·06	+ ·57	138	·46	16	12	7·65	9·92	+2·27	130	29·37	Cawdor
·68	2·87	+ ·19	107	·65	20	7	19·03	21·12	+2·09	111	56·00	Invergarry
·31	6·44	+2·13	149	1·20	16	20	26·21	36·16	+9·95	138	86·50	Bendamph
·81	2·18	+ ·37	120	·35	21	12	9·29	13·27	+3·98	143	31·60	Dunrobin Castle
...	2·34	.	...	·40	25	15	...	13·89	...	...	...	Castletown
·71	2·34	—1·37	63	·41	29	15	19·75	15·84	+3·91	80	58·11	Killarney
·56	1·34	—1·22	52	·49	4	9	12·47	11·70	— ·77	94	39·30	Waterford
·17	1·41	— ·76	65	·44	4	17	9·51	11·90	+2·39	125	33·47	Hurdlestown
·34	1·43	— ·91	61	·51	5	11	10·36	10·47	+ ·11	101	34·44	Carlow
·00	1·83	— ·17	92	·61	29	18	7·99	9·12	+1·13	114	27·75	Dublin
·32	1·58	— ·74	68	·41	4	20	10·74	12·90	+2·16	120	37·04	Ballinasloe
·74	4·34	— ·40	92	·95	4	17	24·35	24·93	+ ·58	102	80·23	Kylemore House
·90	3·48	+ ·58	120	·84	4	20	15·86	18·93	+3·07	119	50·50	Enniscoe
·59	2·09	— ·50	81	·67	24	17	11·75	10·08	—1·67	86	38·61	Seaforde
·32	3·62	+1·30	156	·47	28	21	11·67	16·72	+5·05	143	41·20	Londonderry
·25	3·18	+ ·93	141	·41	24	20	10·55	15·12	+4·57	143	37·85	Omagh

† and 29

SUPPLEMENTARY RAINFALL, APRIL, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	·77	XI.	Rhayader, Tyrmynydd	1·92
,,	Ramsgate, West Cliff Villas	·48	,,	Lake Vyrnwy	1·59
,,	Hailsham	1·62	,,	Llangyhanfal, Plâs Draw	·60
,,	Crowborough, Uckfield Lodge	1·19	,,	Criccieth, Talarvor	1·54
,,	Osborne, Newbarn Cottage.	1·14	,,	Llanberis, Pen-y-pass	4·00
,,	Emsworth, Redlands	·77	,,	Lligwy	1·25
,,	Alton, Ashdell	·85	,,	Douglas, Woodville	1·82
,,	Newbury, Welford Park	1·02	XII.	Stoneykirk, Ardwell House	1·02
III.	Harrow Weald, Hill House.	·47	,,	Dalry, The Old Garroch	1·83
,,	Oxford, Magdalen College..	·34	,,	Langholm, Drove Road	2 00
,,	Bloxham Grove	·62	,,	Moniaive, Maxwelton House	1·51
,,	Pitsford, Sedgebrook	·42	XIII.	N. Esk Reservoir [Penicuick]	1·70
,,	Huntingdon, Brampton	·56	XIV.	Maybole, Knockdon Farm..	1·52
,,	Wisbech, Bank House	1·05	,,	Campbeltown, Witchburn	1·85
IV.	Southend Water Works	·73	XV.	Inveraray, Newtown	3·59
,,	Colchester, Lexden	·88	,,	Ballachulish House	4·45
,,	Newport, The Vicarage	1·04	,,	Islay, Eallabus	3·02
,,	Rendlesham	·57	XVI.	Dollar Academy	1·51
,,	Swaffham	·72	,,	Loch Leven Sluice	1·05
,,	Blakeney	·59	,,	Balquhidder, Stronvar	2·59
V.	Bishops Cannings	1·04	,,	Perth, Pitcullen House	·90
,,	Ashburton, Druid House	·96	,,	Coupar Angus Station	·92
,,	Okehampton, Oaklands	1·67	,,	Blair Atholl	1·30
,,	Hartland Abbey	1·29	,,	Montrose, Sunnyside Asylum	1·14
,,	Lynmouth, Rock House	1·32	XVII.	Alford, Lynturk Manse	1·76
,,	Probus, Lamellyn	1·31	,,	Keith Station	2·01
,,	Wellington, The Avenue	·98	XVIII.	N. Uist, Lochmaddy	2·90
,,	North Cadbury Rectory	1·23	,,	Alvey Manse	2·21
VI.	Clifton, Pembroke Road	1·36	,,	Loch Ness, Drumnadrochit.	1·91
,,	Moreton-in-Marsh, Longboro'	·75	,,	Glencarron Lodge	7·26
,,	Ross, The Graig	·93	,,	Fearn, Lower Pitkerrie	1·46
,,	Shifnal, Hatton Grange	1·77	XIX.	Invershin	2·71
,,	Cheadle, The Heath House.	1·83	,,	Altnaharra	2·33
,,	Coventry, Kingswood	·46	,,	Bettyhill	1·73
VII.	Market Overton	·57	,,	Watten Station	1·52
,,	Market Rasen	·83	XX.	Dunmanway, The Rectory..	1·62
,,	Bawtry, Hesley Hall	·60	,,	Cork	1·06
VIII.	Neston, Hinderton	·81	,,	Darrynane Abbey	2·14
,,	Southport, Hesketh Park	1·02	,,	Glenam [Clonmel]	1·51
,,	Chatburn, Middlewood	1·30	,,	Ballingarry, Gurteen	2·02
,,	Cartmel, Flookburgh	1·65	,,	Miltown Malbay	1·62
IX.	Langsett Moor, Up. Midhope	1·18	XXI.	Gorey, Courtown House	1·38
,,	Scarborough, Scalby	1·06	,,	Moynalty, Westland	1·30
,,	Ingleby Greenhow	1·08	,,	Athlone, Twyford	1·56
,,	Mickleton	·76	,,	Mullingar, Belvedere	1·85
X.	Bardon Mill, Beltingham	1·19	XXII.	Woodlawn	2·21
,,	Ewesley, Fallowlees	1·06	,,	Westport, Murrisk Abbey..	2·68
,,	Ilderton, Lilburn Cottage..	1·00	,,	Collooney, Markree Obsy..	3·01
,,	Keswick, York Bank	1·36	XXIII.	Enniskillen, Portora	2·15
XI.	Llanfrechfa Grange	1·17	,,	Warrenpoint, Summer Hill.	1·59
,,	Treherbert, Tyn-y-waun	1·68	,,	Banbridge, Milltown	2·29
,,	Carmarthen, The Friary	1·17	,,	Belfast, Springfield	2·57
,,	Castle Malgwyn [Llechryd].	1·56	,,	Bushmills, Dundarave	3·13
,,	Plynlimon	3·50	,,	Stewartstown, The Square..	2·46
,,	Tall-y-llyn	1·40	,,	Killybegs	4·68
,,	New Radnor, Ednol	1·39	,,	Horn Head	2·87

METEOROLOGICAL NOTES ON APRIL, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; Ts for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Apart from the low temp. a very fine month, with an extraordinarily large amount of sunshine and practically no rain until the last week. Absolute drought from March 27th to April 12th, and partial drought from March 24th to April 26th, 34 days with ·34 in. of R. The temp. was rather low under the influence of persistent polar winds, the mean being 47°·2, or 0°·9 below the average. Duration of sunshine 192·9*, and of R 9·9 hours.

CROWBOROUGH.—No R fell from March 27th till April 17th, with delightfully warm and sunny days. The latter part was wintry with frequent H and S. R ·99 in. below the average of 35 years. Mean temp. 45°·4.

HARTLEY WINTNEY.—The driest April since 1893. Genial weather prevailed for the first fortnight, but afterwards it was bitterly cold with many frosts.

TORQUAY.—Duration of sunshine 258·8* hours, or 82·8 hours above the average; no sunless days and 14 days with more than 10 hours. Mean temp. 46°·8, or 1°·9 below the average.

NORTH CADBURY.—Abnormally warm until 17th, and as abnormally cold from 18th to 30th, but cold nights throughout. Partial drought from March 16th to April 23rd, 39 days with ·39 in. of R.

CLIFTON.—Mostly anticyclonic weather with N. and N.E. winds. Fine till 20th with cold nights, and the last 10 days very cold with ground frosts.

ROSS.—The first half was splendid and warmer than the average, but the latter half was the coldest in 27 years, except 1884 and 1887.

BOLTON.—Brilliantly fine and warm till about 17th, with almost entire absence of R. The latter part was cold and wet, with S showers and ground frosts. Duration of sunshine 119·5* hours, or 8·6 hours above the average. Mean temp. 43°·8, or 0°·2 below the average.

SOUTHPORT.—Dry and sunny with light E. airs till 12th, W. winds later with R. Mean temp. 45°·2, or 0°·7 below the average. Duration of sunshine 209·8* hours, or 30·8 hours above the average. R ·70 in. below the average. Duration of R 24·9 hours.

CARMARTHEN.—Unusually cold and dry with bitter N. and E. winds. The season was generally backward and R was everywhere badly wanted.

HAVERFORDWEST.—Fine, cold and very dry, with frost on many nights and S on 28th. Vegetation was backward and R much needed. Duration of sunshine 244·8 hours.

DOUGLAS.—Brilliantly fine, dry and very cold to 15th, when the drought, which had lasted 21 days, broke up and was succeeded by wild wintry weather with cold R, frequent S, H and sleet and almost nightly frost.

DUMFRIES.—The promise of early spring growth during the exceptionally mild weather of the first two weeks completely disappeared with the low temp. and withering winds of the second half, when frost caused much havoc.

COUPAR ANGUS.—R again below the average, this being the third successive month with a deficit. Cold nights and warm days; mean temp. 42°·7, or slightly below the average. Vegetation was practically stationary.

DARRYNANE ABBEY.—R 60 per cent. of the average, and less than that of any April except 1872, 1873, 1896 and 1903.

DUBLIN.—A cold month, the mean temp. being 45°·9, or 1°·8 below the average. The first half was very dry, the latter notable for frequent H.

OMAGH.—The first fortnight, although accompanied by polar and easterly winds, was dry and often brilliant, and a highly favourable seed time, but it is seldom we have had more raw, wet, inclement, and generally unfavourable April weather than that from 13th to the end. There were more frosts and S than in any winter month, and vegetation was checked by the cold.

* Campbell-Stokes.

Climatological Table for the British Empire, November, 1905.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	55·2	26	24·2	21	47·4	36·2	39·6	92	75·8	17·5	3·08	19	6·8
Malta	78·1	21	51·3	28	70·8	58·9	55·5	78	118·4	46·8	1·14	7	4·9
Lagos	90·0	30	74·0	24	86·4	75·3	75·4	78	141·0	62·5	3·65	9	6·5
Cape Town	81·2	18	45·7	21	71·3	54·9	53·1	70	...	...	·89	5	3·4
Durban, Natal	89·1	3	54·4		77·8	63·3	...	...	151·5	...	6·87	16	6·4
Johannesburg	84·8	30	42·0	7	73·0	52·7	51·9	72	159·2	43·0	6·05	13	4·0
Mauritius	89·0	17	60·5	2	83·4	67·3	65·7	74	149·7	53·1	4·09	13	6·6
Calcutta	87·0	12	57·1	17	83·1	63·6	62·4	70	149·0	51·5	·00	0	1·8
Bombay	93·2	8	68·3	27	88·9	74·9	69·2	67	142·3	61·9	1·04	3	3·0
Madras	89·5	2	67·9	5	85·8	73·7	72·1	81	140·8	63·8	10·99	16	5·8
Kodaikanal	65·1	1	41·8		60·8	49·5	50·8	88	134·8	35·3	7·77	20	6·3
Colombo, Ceylon	90·8	6	73·0	6	87·4	75·1	73·4	82	157·5	69·0	5·12	18	5·3
Hongkong	84·5	3	59	5	73·6	65·0	57·1	66	138·1	...	·28	8	4·8
Melbourne	93·5	8	41·5	13*a*	71·0	49·6	47·8	67	152·3	32·0	1·25	6	5·5
Adelaide	92·4	15	42·9	5	75·5	51·1	47·3	56	151·0	34·1	·15	2	3·6
Coolgardie	107·2	24	43·4	11	87·9	56·0	45·7	39	169·1	39·2	·21	3	2·2
Sydney	98·1	17	45·8	1	76·6	58·7	52·9	60	134·9	38·8	·63	14	4·5
Wellington	71·8	18	43·8	9	62·4	50·5	46·6	68	132·0	39·0	3·32	15	6·7
Auckland	71·0	30	45·0	10	64·9	53·7	49·8	72	136·0	39·0	2·20	14	5·0
Jamaica, Negril Point	88·9	20	68·9	28*b*	86·6	71·6	73·0	81	...	...	5·75	10	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	86·2	6	71·8	26	83·7	74·9	80·8	95	154·0	...	12·23	25	4·7
Toronto	54·0	11	12·7	30	43·6	30·2	30·1	77	68·0	8·2	1·78	13	6·3
Fredericton	56·8	25	−2·5	15	43·2	23·7	24·3	62	...	...	3·58	11	6·3
Winnipeg	59·5	10	−21·0	30	35·1	18·2	...	...	...	...	1·13	7	5·5
Victoria, B.C.	59·2	12	27·9	28	49·0	40·5	...	90	...	...	·91	11	7·1
Dawson	46·0	10	−20·0	26	15·9	4·8	...	...	...	...	·31	5	6·4

a and 29. *b* and 29.

MALTA.—Mean temp. of air 63°·6, or 1°·7 above average. Mean hourly velocity of wind 10·0 miles, or 0·6 above average. Mean temp. of sea 67°·9.

Mauritius.—Mean temp. of air 0°·6 below, of dew point 1°·4, and R 2·26 in. above, averages. Mean hourly velocity of wind 9·3 miles, or 1·4 below average.

MADRAS.—Bright sunshine 160·5 hours.

KODAIKANAL.—Bright sunshine 114 hours.

COLOMBO.—Mean temp. of air 80°·8, or 0°·9 above, of dew point 1°·1 above, and R 7·06 in. below, averages. Mean hourly velocity of wind 5·7 miles.

HONGKONG.—Mean temp. of air 69°·2. R 1·43 in. below average. Mean direction of wind E. by N., and mean hourly velocity 12·4 miles. Bright sunshine 209·0 hours.

Adelaide.—Mean temp. of air 3°·9 below, and R ·85 in. below, averages; one of the driest Novembers on record. Mean min. temp. lowest on record for 48 years.

Sydney.—R 2·42 in. below, mean temp. 0°·8 above, and humidity 9 below, averages.

Auckland.—R not quite two-thirds of the average of previous 37 years.

Symons's Meteorological Magazine.

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THE RAINFALL OF MAY AND THE FIVE MONTHS OF 1906.

OUR rainfall tables and correspondence this month show that May was wet, and in some parts of the country an unprecedentedly wet month. As not infrequently happens towards the end of spring, there were local thunderstorms of considerable intensity which brought heavy plumps of rain to small areas. The most conspicuous case of this was at Brundall, near Norwich, where 3·21 in. fell in twelve hours on May 13th, and consequently at that station the total rainfall of the month was more than two and a half times the average. Other instances occurred at Haslemere and at Upton, near Slough, on the 8th, when about 2 inches fell at certain stations, while, as in the case of Brundall also, at stations not many miles distant there was quite a moderate fall. Apart from such local splashes the great block of central England reaching from London and Bath on the south to Hull and Derby on the north was dry, the rain which fell over it being only about 80 per cent. of the average. A dry patch also occurred along the sheltered east coast of the South Devon peninsula. All the rest of the country was wet, and over the north of England and the centre and east of Scotland more

Comparison of May, 1906, *and the Wettest Previous May.*

	Record commenced.	Aver. 1870-99.	May, 1906.	Per cent. of Aver.	Wettest previous May.		
					Amount	Per cent of Aver.	Date.
		in.	in.		in.		
Arncliffe	1859	3·36	7·08	211	6·72	200	1892
Newcastle, Town Moor	1868	1·89	4·78	253	3·59	190	1899
Ilderton, Lilburn	1856	1·95	8·15	418	4·93	253	1865
Pawston [Coldstream]	1873	1·95	8·10	416	4·00	205	1885
Borrowdale, Seathwaite	1845	7·26	16·10	222	17·09	235	1884
Cargen, [Dumfries]	1860	2·60	7·00	269	6·66	256	1865
Edinburgh, Charlotte Sq.	1850	1·86	4·91	264	4·11	221	1886
Dundee, E. Necropolis	1866	1·88	5·00	266	4·00	213	1899
Braemar	1857	2·29	5·45	238	6·18	270	1873
Dunrobin Castle	1860	2·02	4·50	223	3·55	176	1894

than twice, and over the Cheviot Hills more than four times, the average amount of rain fell. The west coast, although receiving nearly half as much again as its usual liberal allowance of rain, was almost equalled in the total amount recorded along the normally dry east coast. There were, in fact, very few places in Scotland in which the rainfall of May did not exceed 5 inches. To concentrate attention on this area of remarkably large rainfall we quote the figures recorded at a few of the stations which possess long records and add for each station the greatest fall in May previously reported. We regret, however, that our Scottish readers in the wet area have not favoured us with more details of their rainfall.

The area referred to last month as having escaped most of the earlier heavy falls came under the full influence of the May rains, with the result that practically the whole of the British Isles has now received more than the average fall for the five months. There may be a deficiency in the extreme south-west of Ireland, and a very slight deficiency in a narrow strip of the northern Midlands in England; but the general rainfall of England and Wales for so much of the present year as has passed may be taken as showing an excess over the average of 20 per cent., Scotland 23 per cent., Ireland 18 per cent. and the British Isles as a whole 20 per cent.; in other words, there is, compared with the average of thirty years, about one month's rainfall to the good. So far, then, we may say, even if June should turn out a dry month, that the first half of the year justifies the expectation, based on the frequent recurrence of a wet year preceded by two dry years, that 1906 may prove wet on the whole.

LINE SQUALLS AND THUNDERSTORMS.

THE following is an abstract of an important paper on the law of squalls and thunderstorms,* by E. Durand-Greville :—

Upon the approach of a line-squall the wind suddenly increases in force and changes in direction, generally from south-west to north-west. These changes in the force and direction of the wind are accompanied by a considerable fall of temperature and a considerable increase of humidity; in the case of hot, dry squalls like the simoon of the Sahara and the sirocco of southern Europe, these changes of temperature and humidity do not occur. The squall may bring a storm of rain, hail or snow according to the season, with or without thunder and lightning.

The barometer which falls rapidly immediately before the squall, shows a sudden increase of pressure as soon as the wind increases in force. The barogram of a squall is very characteristic, showing this sudden rise of the barometer.

All places which are affected by the squall at the same time form a long continuous strip, from six to thirty miles or more in breadth, called the

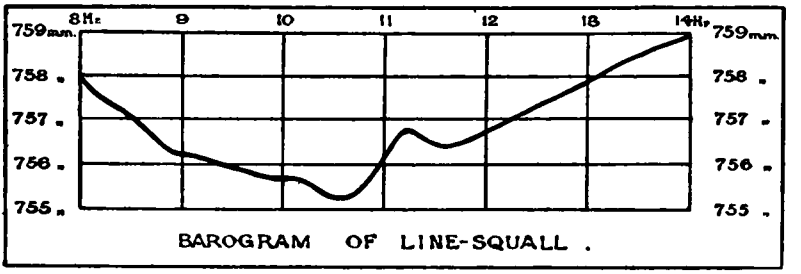
* "Le loi des Grains et des Orages," in Nos. 12 (1905) and 1 (1906) of the *Bulletin de la Société Belge d'Astronomie.*

squall strip (*le ruban de grain*). One of the extremities of the squall strip is generally found near the central region of the atmospheric depression in which it occurs; the other extremity occasionally extends into a contiguous anticyclone. When the atmospheric depression, in which the squall occurs, has a rapid movement of translation the squall area protuberates in the corresponding direction; when, however, the depression moves slowly the squall strip rotates like the spoke of a wheel, round the centre of the depression in a direction, north of the equator, opposite to that of the hands of a watch. The isobars of a line-squall have a characteristic zigzag shape (see figure). Several squalls may exist in one atmospheric depression, and these may greatly interfere with the normal sequence of phenomena as observed at any given place.

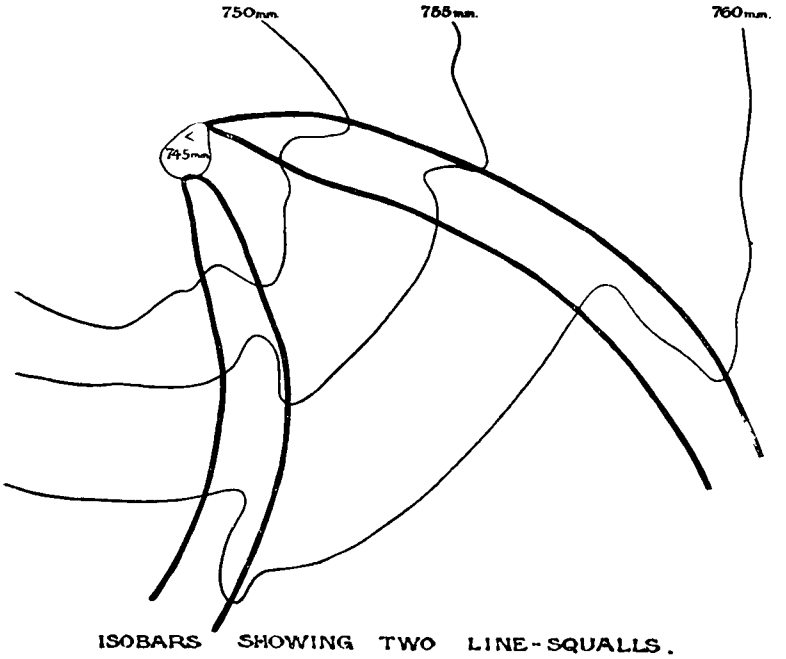
It seems probable that the squall is fed by a descending current of air from a long distance and a great height, and that it in turn feeds an ascending current of air, which moves away from the squall in the opposite direction. The descending wind *in* the squall strip, and the ascending wind *in front* of it, would explain the fact that pressure is abnormally high in the former area and abnormally low in the latter. Over the entire area of the squall barometric pressure is higher, humidity greater, temperature lower and wind stronger, than in front or in rear of the squall. In the United States, tornadoes occur along the front line of the squall area. Wherever the squall, in its passage across the land, finds suitable atmospheric conditions it produces destructive rain and hailstones; hence, hailstorms are most frequent and violent during the warm period of the year.

Over large portions of the squall area the sky is clear, over other large portions it is overcast, whilst over restricted portions of the cloudy area disastrous rain and hailstorms, accompanied by thunder and lightning, occur.

Monsieur Durand-Greville insists that the majority of thunderstorms in middle latitudes are of the line-squall type discussed in this paper. This, no doubt, is the case in France; but neither the investigations of the British Thunderstorm Committee, nor our general experience of summer thunderstorms in England, associate these phenomena ordinarily with the passage of line-squalls moving laterally across the country. Probably the difference between the atmospheric conditions accompanying French and English thunderstorms is of degree only not of kind, and English thunderstorms may not be fully developed phenomena as compared with French. Summer thunderstorms in England are usually associated with a local squall, sometimes at the Earth's surface but more generally a little above it, and the conditions giving rise to these local squalls might be found could a minute enough study of the general atmospheric conditions accompanying thunderstorms be made, to represent the embryo conditions of a line-squall. It must not be forgotten that the summers of England are cool and moist, those of France hot and dry, and that, consequently, the state of the atmosphere in the latter country at that season is eminently conducive to the development of frequent and severe thunderstorms.



BAROGRAM OF LINE-SQUALL.



ISOBARS SHOWING TWO LINE-SQUALLS.

The figures, which are adapted from Monsieur Durand-Greville's paper, show respectively the barogram and isobars characteristic of line-squalls. In the first it will be seen that the sudden increase of pressure which occurs when the squall strikes a place, is preceded by an increased rate of fall of the barometer. In the second the two ribbon-shaped squall areas and the sharp inflections of the isobars associated with them call for remark.

L.C.W.B.

DR. W. N. SHAW ON THE CIRCULATION OF THE ATMOSPHERE.

II.—The second lecture of Dr. Shaw's Course at the University of London was devoted to illustrations of the weather experienced in different parts of the general circulation of the atmosphere, referring in turn to the regions of permanent high pressure, those of persistent winds, areas subjected to tropical hurricanes, regions of periodical or monsoon winds, and finally the region of the North Atlantic "low." Rainfall was more particularly considered as the most convenient index of weather conditions. It was pointed out that in no part of the ocean is there persistent or absolute drought, though in the permanent high pressure areas and those of the Trade Winds the rainfall is small and infrequent over the sea. Thus near sea level at St. Helena and Ascension only 4 or 5 inches fall, whereas inland at an altitude of 2000 feet as much as 40 or 50 inches per annum have been observed.

The rainfall in the monsoon regions was illustrated by diagrams taken from a recent publication of the Solar Physics Observatory, showing how the rainfall was associated with the summer cyclonic circulation.

The phenomena of tropical revolving storms was illustrated by a diagram of the *baguio* of October, 1882, by Father Algué, of Manila Observatory.

Various examples of depressions of the North-east Atlantic were examined, first as to their broad features, showing how masses of air which move toward the centres of depressions are responsible for the deposition of rainfall. These frequently converge greatly and in slow-moving cyclones deposit large amounts of rain.

Changes due to minor disturbances of pressure were exhibited by diagrams giving examples of sudden barometric change and fall of temperature with heavy rain, and finally still smaller but none the less distinct disturbances shown by the micro-barograph alone.

III.—In the third lecture attention was first directed to the normal circulation taking place in that portion of the atmosphere lying at an altitude of more than 4000 metres above the surface of the Earth. M. Teisserenc de Bort's map of the pressure distribution at this high level for January shows that the main feature is a general movement from west to east round the poles, modified in the northern hemisphere by deviations from N.W. over the land areas and S.W. over the oceans. This map was produced by deducting from the average atmospheric pressure at the surface the computed weight of the stratum of air below 4000 metres, and a map of the pressure due to the lower stratum alone was exhibited in order to bring to notice the remarkable fact that the lie of the isobars is strikingly similar to that in the upper stratum, but with the gradients in every case reversed.

The surface pressure conditions may therefore be looked upon as the result of the superposition of two different components, each nearly the reverse of the other, the upper tending to produce a circulation of air from west to east round the poles and the lower, due to surface temperature, a circulation from east to west. As a consequence westerly circulation results where the upper component predominates, easterly where the lower is more powerful. It is noticeable that, as a matter of fact, the lower component seems seldom to preponderate, but this may probably be accounted for by the imperfect investigation of the areas of greatest cold where the surface circulation is strongest.

Good confirmation of the theory of circulation advanced is obtained from the observations made by the Antarctic Expedition on the *Discovery*, near Mount Erebus, where the mean wind direction shows a decided tendency to be easterly at the lowest point of observation, is about equally divided between all points of the compass at middle altitudes and is strongly westerly at the summit. The easterly drift at the surface was borne out by the German expedition on the *Gauss* which wintered on the Antartic circle some seventy degrees west of the longitude of the *Discovery.*

The relation of rainfall to the general circulation and local disturbances was also discussed, and it was pointed out that the deposition of rain is almost entirely due to the ascent of masses of air bringing about rarefaction and cooling. This is equally the case with the rainfall accompanying depressions, with orographical rainfall, and with rain of the local or thunderstorm type. Several diagrams were exhibited with a view to showing that the moisture deposited as rain in this country is taken from air moving from south to north approaching the centres of depressions. Currents from the south consequently travel for comparatively short distances before disappearing and are therefore less persistent than easterly and westerly currents. They may be considered as supplying the energy necessary to maintain the general westerly circulation of the atmosphere and are powerful agents in distributing the heat of the Sun over the Earth.

Maps were also shown which demonstrated in what respects deviations from normal conditions may influence the weather of individual months and thus exercise a temporary effect on the whole circulation.

(*To be continued.*)

TREACHEROUS CHARACTER OF THE ENGLISH SPRING.

By L. C. W. Bonacina.

The treacherous and changeable character of the weather during the months of March, April and May is one of the most prominent and constant features of the climate of the British Islands.

It is quite a common occurrence for a day in April or May, with afternoon temperatures between 70° and 80° F. in the shade, to be followed within forty-eight hours by harsh northerly winds, squalls of sleet and hail, afternoon temperatures between 40° and 50° F. and keen night frosts, inflicting serious injury upon vegetation at the critical period of the year. The spring of the present year 1906 has been remarkable only in this, that the changes of temperature have occurred with more than usual rapidity and suddenness.

Cloudless skies, brilliant sunshine and shade temperatures between 60° and 70° F. on the 6th and 7th of March were followed during the night of the 12th in the London district by the heaviest fall of snow of the winter. On the 17th the conditions of the 6th and 7th repeated themselves, and on the 19th there set in a ten-day period of really terrible weather, of which the cold was conspicuous, not so much for its intensity as for the raw, disagreeable qualities of the north-easterly wind which brought it.

The first half of April was brilliantly fine, with moderately high day temperatures, and just before Easter there occurred a few days of thundery heat with temperatures locally over 70° F. Immediately after Easter these summerlike conditions gave place to a very bleak type of weather, with cold rain, hail and snow squalls (very heavy snow fell in Scotland), which with but little interruption lasted till the close of the month.

The snowstorm of the morning of the 24th of April was experienced very generally in the east and south-east of England and in places it was heavy.

The late spring month, May, did not fail to reproduce the sudden and rapid temperature variations of the early and mid-spring months, March and April. On the 8th of May the shade temperature was between 70° and 80° F. in the south and centre of England, and a severe thunderstorm occurred towards evening in east Berkshire (two inches of rain at Slough) and west Middlesex. Forty-eight hours later, on the 10th, temperature barely reached 50° F., the wind being north with overcast skies and characteristic tawny horizon. Thundery conditions, with temperatures over 70° F. in the shade, recurred on the 13th. On the 17th a well-marked snow sky prevailed in London and the maximum temperature was no higher than 49°; snow showers fell in several parts of the country that day and at 6 p.m. sleet, accompanied by a bleak northerly gale, was actually falling in the Scilly Isles (*Weather Report*). During the night of the 17th the air temperature fell to 28° F. at Nottingham

and a severe ground frost was experienced generally. In the Darenth Valley, in Kent, much of the late expanding foliage of oak and ash was blackened by the frost. After a cold and heavy northerly wind, rain, exposure to which numbed the fingers, on the 20th, the weather assumed a softer and more summerlike character, and the gentle rains of the 26th were associated with some very beautiful mountain mists in the hill-country of the Kent and Surrey borderland.

The spring of 1906 has, on the whole, been a typical English spring so far as treacherous weather is concerned, but owing to the prolonged drought of March and April the most delicate verdure of the year, as exhibited by the larch, elm and horse-chestnut, was inferior to that of many other years.

The changeable and uncertain weather of the spring months, associated as it is with a mean temperature that normally does not, even in the south, reach the temperate* level, 55° F., till the latter part of May, though distressing to invalids and often inconvenient to the strong, has the effect of greatly enhancing the peculiar charm of the spring in a land so green as England, where the various elements of greenery show different and contrasted phases of beauty with the different types of weather. Consider. for example, the pageantry of our woodlands during the month of May; then the woodlands with their blue carpet of wild hyacinths striking so great a contrast against the reddish-green tint of the expanding oak foliage above them, reveal subtle passages of beauty that alter in tone and expression with every change of weather.

The causes of the uncertain weather of spring must be attributed to the fact that solar radiation is powerful at that season, whilst the ground and air remain cold. The returning sun always tends to produce local areas of high temperature, especially in districts away from the sea, and as these local heat areas are surrounded by large areas which have not thus been heated, a speedy relapse into the cold of winter over the former areas is inevitable. Besides this, there is a great tendency for cold north-easterly winds to prevail in spring as the result of the excess of air accumulated over the great continents during the winter months.

There is another peculiarity of spring weather in England that is worth notice: it is, that snow is apt to fall with much higher temperatures in spring than in winter or late autumn. During the spring months snow showers frequently prevail when the temperature of the air near the surface of the land, as an effect of solar radiation, is between 40° and 50° F. (although a heavy snow-squall will in-

* The fixing of 55° F. as temperate is by no means arbitrary, as this temperature, though nearly 44° below the temperature of the human body, appears on the whole to be more comfortable than any other to men in health and in civilized life, as is evidenced by the fact that whenever the temperature of the air is below that point the need for sitting-room fires makes itself felt, whilst whenever it is much above that point artificial heating in the house becomes oppressive.

variably cause a temporary reduction of temperature to the freezing point), whilst during the winter months snow seldom falls with a temperature as high as 40° F. This indubitably proves that the relatively high temperature often accompanying spring snow-showers belongs to the surface air only, the strata of air at a short distance from the ground and up to the clouds being intensely cold. The same northerly type of weather in winter would be accompanied by surface temperatures near the freezing point, a temperature over 40° F. in winter generally only occurring when a mild wind of considerable height from the Atlantic prevails, rendering the formation of snow-clouds impossible. During January, 1906, a month it will be remembered of rain-bearing cyclonic storms, snow-clouds were scarcely ever seen in the south of England, whereas during February, March and April they were the prevailing cloud forms, and even in May were quite common, being very conspicuous on the 10th, 16th and 17th.

ROYAL METEOROLOGICAL SOCIETY.

THE first of the Afternoon Meetings for the present session was held on Wednesday, May 16th, in the Society's Rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, in the chair.

Dr. W. N. Shaw, F.R.S., read a paper, which he had prepared in conjunction with Mr. G. C. Simpson, describing an Instrument for testing and adjusting the Campbell-Stokes Sunshine Recorder. Experience has shown the necessity of an instrument for testing the shape and dimensions of recorders, and of verifying their adjustment when installed. But it is not at all easy by mere inspection or simple measurements with ordinary measuring instruments to check the adjustment, nor is it possible on a sunless day, without some special appliance, to check the orientation and thus the time scale of the sunshine recorder. The difficulty in carrying out the necessary tests without a special instrument arises from the fact that the positions of all the parts of the recorder must be referred to the optical centre of the glass ball. For suitably uniform glass this is also the geometrical centre of the sphere. It is inaccessible for purposes of measurement when the sphere is in position, and is entirely undefined when the sphere is removed. The first step in designing an instrument for testing recorders is, therefore, to get some means of identifying, in a way that can be used practically, the centre of a 4-inch sphere placed in the pedestal. This has been done by making a metal cone, the base of which is accurately turned to form a portion of a sphere of two inches radius and the point is at the exact centre of the spherical surface. Thus the point of the cone will always be in the position of the centre of the recording ball when the base of the cone stands on a pedestal. The second step is to provide a table, with levelling screws, that will carry a pair of adjustable

points to be set level and form the ends of a line (the axal line) touching the six o'clock marks at each end. The third step is to provide a pointer that sweeps round in a plane, passing through the axal line. The fourth step is to provide the means for setting the plane in which the pointer moves at any angle to the horizontal table, in order to test the adjustment for latitude. The fifth step is to provide the means for determining with the aid of a map that the axal line should be exactly east and west.

Dr. Shaw showed the complete instrument, which had been made from Mr. Simpson's drawings.

In the discussion on the paper, Mr. R. H. Curtis, Mr. W. Marriott, Mr. R. Inwards, Mr. F. C. Bayard, Mr. W. Ellis, and the President took part, and Dr. Shaw replied.

Mr. R. G. K. Lempfert read a paper on "The Development and Progress of the Thunder-Squall of February 8th, 1906." This squall was first noted at Stornoway soon after midnight, and the last station in England to feel its effect was Hastings, over which it passed at about 4 p.m. The rate of progress was nearly uniform, though it increased somewhat in the south-east of the country, where the thunder and hailstorms were most intense. The average speed of advance of the line of squall was about 38 miles per hour. The most marked feature of this squall was the sudden shift of the wind, in the course of a few minutes, from south-west to north-west, and it was during this period that the thunderstorm occurred, accompanied by a rise of barometric pressure and a fall of temperature.

The discussion on this paper was postponed till the next meeting on June 20th.

The following gentlemen were elected Fellows of the Society :— Dr. A. G. R. Cameron, Mr. E. W. Stacey Jones, Mr. H. K. Mukherji, Capt. R. Parcou, Capt. W. H. Rothwell, and Mr. L. C. H. Young.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

ON COLD IN FEBRUARY AND MARCH.

My estimate of March this year as cold at Greenwich is based on the daily means published in the *Weekly Return*. By another mode of calculation (max. and min.) the month comes out slightly *over* (instead of slightly *under*) the average, so according with your own result for Camden Square.

ALEX. B. MacDOWALL.

Southgate, Buxton, 1st May, 1906.

THE GREEN FLASH.

WHILE I entirely accept the explanation of the "Green Flash" so admirably expounded by Dr. Rambaut, I fear I must still hold to the opinion that it does not explain all the phenomena that have been described under this name. The common "green," or as I would rather call it "blue" flash which I have seen, perhaps a hundred times, is undoubtedly caused in the way described by Dr. Rambaut, but there is another phenomenon which I have seen on a few occasions, which is almost as certainly due to atmospheric absorption. In it the upper part of the sun's disc when setting becomes a vivid green for several seconds before disappearing, and in the light then given objects of a green colour appear with extraordinary vividness. Probably closely allied with this phenomenon is one which I have seen here on two or three occasions, when the whole sky became filled at sunset with what seemed to be a green mist, which produced the most lurid effects.

C. MICHIE SMITH.

The Observatory, Kodaikanal, South India, 15th May, 1906.

WITH reference to the green flash, nearly all your correspondents mention the evening, while my sight of the green was always, or nearly always, in the morning. I appear to have been more fortunate than most of them, as I was a witness to the flash some twenty times during a voyage from Tasmania to England. I mentioned the matter to a Captain in the Navy, who had been all over the world, but he did not remember that he had ever seen it.

GEORGE H. COURTENAY.

Southtown House, Kenton, Exeter, May 20th, 1906.

AS, in his interesting articles in the March and April numbers, Dr. Rambaut has kindly mentioned my name, perhaps I may be allowed to say that I entirely agree with his explanation of the Green Flash. I have seen the flash some dozens of times, over land, sea, and cloud horizons, recognised from the first its unquestionable objectivity, and accounted for the phenomenon by atmospheric dispersion.

But there is one real difficulty—that pointed out (p. 67) by Capt. Wilson-Barker—viz. : the absence of the flash under conditions apparently very favourable to its production, and I have not yet met with any satisfactory explanation of this fact. Upon this point reference may be made to the *Journal* of the British Astronomical Association, Vol. **15**, pp. 382-4, and Vol. **16**, pp. 23-5.

As another example of the mention of the Green Ray in fiction, I may instance Mrs. F. A. Steel's novel, "Red Rowans."

C. T. WHITMELL, F.R.A.S.

Invermay, Leeds, May 19th, 1906.

I DID not intend to trouble you again on the subject of the "Green Flash" sometimes to be seen at sunrise and sunset. I do so because I feel sure that many of your readers are not aware of the fact that this phenomenon may be seen by anyone who takes a little trouble on any evening when the sun is sinking below the horizon, and his disc is coloured red. Anyone who wishes to see the phenomenon has only to look for a few seconds at the red disc of the sun as it sinks below the horizon and then to alter slightly the direction of his eyes and the spectrum of the sun in the complementary green colour, which is the Green Flash, will at once be seen. If the disc of the sun happens to be orange colour the spectrum will be blue.

R. C. CANN LIPPINCOTT.

Over Court, Almondsbury, Bristol, 7th June, 1906.

CONTINUOUS RAINFALL.

THE rainfall registered here for May was 5·36 in., an amount not equalled for that month in my record since 1860, inclusive. Some rain fell on every day in the month, but on seven of the days there was not sufficient to be measured. For the 24 hours ending at 8 a.m. on the 20th 2·41 in. fell, which has only been exceeded five times in my record. Some rain has fallen on every day from April 21st to June 1st, inclusive. For the first five months of the year 10·70 inches were registered, which was 1·90 in. above the average.

T. W. BACKHOUSE.

West Hendon House, Sunderland, 2nd June, 1906.

THE past month of May has been remarkably wet, the wettest I have ever recorded, the next being May, 1885, when I had only 4·00 in. The wettest months of which I have any record are—

Dec., 1876	9·07 in.	Oct., 1896	7·44 in.
Aug., 1877	8·21 ,,	Oct., 1895	7·02 ,,
May, 1906	8·10 ,,	Oct., 1903	6·99 ,,

I have not got the *daily* records for 1876 and 1877, so cannot tell what was my wettest week then; the week 13th to 19th May, 1906. is the wettest of which I have existing records; perhaps my daily records *may* be buried amongst Mr. Symons's old papers. A year or two ago, when I heard of falls of 8 inches in the month of June in the Thames Valley, we had only about 2 inches here.

My neighbour, Mr. T. Chartres, Akeld, Wooler, started a rain gauge at Christmas and reports to me that 6·28 in. fell in the first four months of the year, and 2·45 in. on May 19th, almost identical results with mine. The little mountain stream College was, I hear, unusually wild, and accounts for Till and Glen, into which it runs, being more heavily flooded than Bowmont (Bowmont and College meet and become Glen). The wild character of College is immortalized in Lyell's "Principles of Geology," Vol. 1., p. 345, 11th edition, 1872.

B. P. SELBY.

Pawston, Mindrum, Northumberland, June 1st, 1906.

THE LIGHTNING RESEARCH COMMITTEE.

THE Report of this Committee, to which reference is made in the recent review of Mr. Hedges' book, was published in May, 1905, in the Journal of the Royal Institute of British Architects. It is a remarkable document and is so contradictory that it is difficult to gather what the Committee did, or did not, intend to convey.

The statistics quoted are of no more value than the recommendations it contains. It is stated that out of 125 reports received, 40 related to buildings fitted with conductors, and the context leads to the impression that these cases occurred in three years. An appendix gives what purports to be a "selection" from these 40 cases, 35 being mentioned. On analysing them we find that 8 are not damage to "protected" buildings, 1 is a case of long standing injury to a spire that no expert would attribute to lightning, and 2 occurred before the Committee was formed. This leaves 24 cases of so-called failure of lightning conductors, an average of less than 8 a year, as against nearly 400 "unprotected" buildings damaged by lightning annually in this country.

The Committee apparently ignored the fact that most of these conductors had been in use for terms varying from 20 to 60 years: had never been tested or repaired during that time; had mostly been fixed by builders, ironmongers and others not to be credited with expert knowledge, and all had grave faults that would have led a qualified expert to condemn them as inefficient before the accidents occurred. A member of the Committee, Mr. Gavey, has since publicly stated that the appendix is a complete list and not a selection, and the honorary secretary, Mr. Hedges, has acknowledged that the figures are incorrect, yet, in the book that claims to be a supplement to the Report and was published after these admissions, the statement is repeated in its original form.

It is obvious that the cases were not all adequately or even correctly described, so the Report cannot claim to be based on investigation of these. On what then is it based? Possibly on experiments by Sir Oliver Lodge, which in their practical application were strongly combated when they were carried out in public, and would be still more strongly opposed if repeated now; but it is certainly not based on extensive practical experience of the subject.

The apparent confirmation of the recommendations of the Lightning Rod Conference, which have been tested for the past 25 years and have never been known to fail, is negatived in other parts of the Report and, as an improvement, the Committee advocates methods that it declares to be ineffective! One can only say that where this Report is good it is not new and where it is new it is not good.

The Conference promoted by the Royal Meteorological Society went exhaustively into the subject so far as it was understood at the time; it invited the views of the experts of the day, compared them, rejected what appeared bad, adopted what seemed good, practice, and it issued a Report that was intended to enable the average householder to see that the most effective methods that science could

devise were being applied to his building. Knowledge has progressed since then, and this Report is open to improvement in several respects, but the recent Committee has not produced an improvement but rather a retrogression, and it has only succeeded in causing distrust in the minds of those responsible for buildings as to the effectiveness of such methods of protection as are possible of application. The result is likely to be an increase in damage by lightning and many deplorable accidents that might have been prevented had different methods of investigation been adopted. ALFRED HANDS.

London, 9th June, 1906.

THE THUNDERSTORM OF MAY 8th.

As your pages record the thunderstorm of May 8th, you may like to record also an exceedingly local fall at Longdene, Haslemere, during that storm. Unfortunately the gauge is badly placed, amongst trees on a garden bed and the previous entry was made on May 1st. The rain was sudden, of great violence (washing a bed out of its place on to the garden path), and occurred between 4 p.m. and 6 p.m. At 6 p.m. the gauge was visited and contained 2·75 in.

The R during May 1—7 at Hazelhurst was ·46 in.; supposing it the same at Longdene, 2·29 in. is thus left for the two hours' fall. But something must come off for splash; and the net fall would seem to have been about 2 inches.

At Court's Hill (Mr. Penfold), within half a mile, ·58 in. was recorded; at Jesses (Mr. Parbury), ·71 in.; at Hazelhurst, one mile N.W., ·62 in.; at Grayshott (Mrs. Lyndon), four miles N.W., 1·13 in.

Hazelhurst, Haslemere, Surrey, 6th June, 1906. T. P. NEWMAN.

THE PACKING OF METEOROLOGICAL INSTRUMENTS.

I READ the letter by "A. W." on the packing of meteorological instruments with great interest. My experience has been much more favourable than his. One London firm has sent me I should think pretty well a thousand pounds' worth, from time to time, and the damage to the whole lot would be covered by a £5 note. Some other firms, however, have certainly not learned how to pack. If I knew "A. W.'s" address, I should be glad to send him a specimen of my wick for wet bulbs. I will guarantee it to last for three months even in the Sahara, if properly handled. I think that all services should prepare the wick and muslin for their observers. From my own experience I should say that the black or bright bulbs could often be tested in the same way as "A. W." mentions, even in England.

We have had some glorious rains this year; not the usual heavy downpours that convert the streets into raging torrents, but steady soaking rains lasting for 20 hours at a stretch. Consequently, the country looks lovely, and very different to its burnt-up appearance when the British Association went through six months ago. J. R. SUTTON.

Kimberley, S. Africa, March 20, 1906.

AUTOMATIC RECORD OF A THUNDERSTORM.

THE enclosed records given by my instruments of a fierce thunderstorm which occurred here this afternoon may interest your readers.

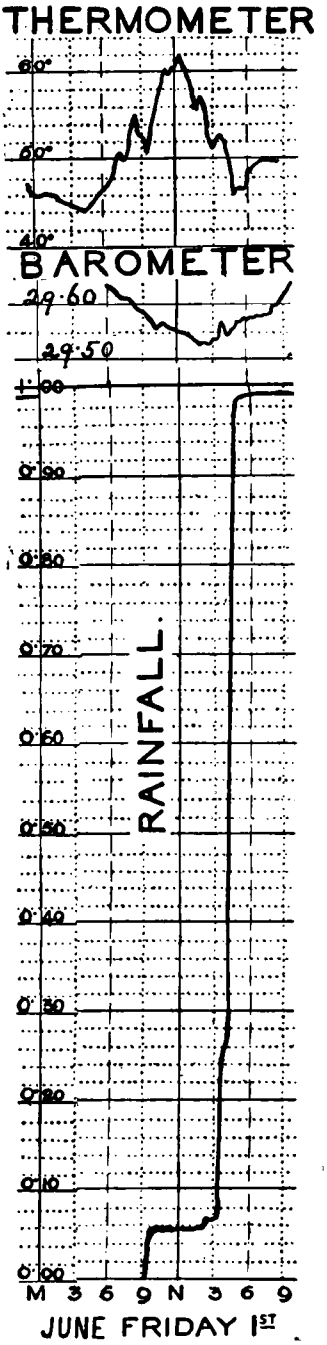
The storm, or rather series of storms, commenced at 2.30, and lasted until nearly 5 p.m. It was accompanied by a large quantity of hail, the stones being unusually large, a quantity of sleet also fell: the ice remaining on the ground an hour or more and lowering the grass minimum thermometer to 33°, an unusual reading for June. The total rainfall (hail, sleet and rain) was nearly 1 inch, and most of this fell in 1½ hours. The temperature was very variable, dropping to 46° at 5 p.m. The wind veered to the north for a few minutes, but soon backed to S.W. again. The barograph shows the sudden fluctuations so characteristic of thunderstorms.

Some houses a few yards away were struck by the vivid lightning, and the telephone was cut off. This place, although much higher and having my anemometer on top of 30 feet of iron tubing on the roof, besides the tall wireless telegraph aerial, was uninjured. Wireless telegraphy is a very useful means of foretelling unsettled thunder weather. For a number of days my instrument has indicated an increasing amount of atmospheric electricity, but now to-night, after the storm, all this has gone, and I am able to receive messages from very long distances with unusual clearness.

A. LANDER.

Canterbury, June 1st, 1906.

[Mr. Lander does not state whether an arrangement for melting the hailstones as they fell was attached to his rain gauge, or whether only that part of the precipitation falling as rain is accounted for in the trace.—ED. *S.M.M.*]



TEMPERATURE FOR MAY, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32° Shade.	Grass.
		° ′	° ′							
Camden Square	*London*	51 32	0 8	111	78·9	8	32·1	1	0	3
Tenterden	*Kent*	51 4	*0 41	190	72·5	12	32·5	1	0	5
West Dean	*Hampshire*	51 3	1 38	137	74·0	13	29·0	2	4	7
Hartley Wintney	,,	51 18	0 53	222	76·0	8	28·0	2	2	5
Hitchin	*Hertfordshire*	51 57	0 17	238	75·0	8	32·0	17	1	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	75·0	8	30·0	2, 18	3	5
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	73·0	28	30·0	1	1	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	71·7	13	29·0	1	5	5
Torquay (Cary Green)	*Devon*	50 28	3 32	12	69·1	14	36·0	1	0	1
Polapit Tamar [Launceston]	,,	50 40	4 22	315	70·2	13	30·1	19	1	1
Bath	*Somerset*	51 23	2 21	67	73·5	13	30·0	2	3	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	72·0	13	35·0	1	0	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	67·5	7, 13	27·0	2	6	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	69·0	8	28·0	4	2	...
Boston	*Lincolnshire*	52 58	0 1	25	74·0	8	32·0	2	1	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	72·4	8	27·3	1	3	5
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	78·0	8	32·0	18	1	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	63·7	13	35·4	2	0	5
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	70·0	27	30·0	1	2	6
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	68·6	13	30·2	1	1	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	71·6	13	33·7	19	0	5
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	77·0	13	30·0	18, 19	4	...
Llandudno	*Carnarvon*	53 20	3 50	72	65·0	24	36·5	2	0	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	69·0	13	28·0	1	2	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	66·0	13	28·0	4	4	5
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	62·7	27	32·5	1	0	5
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	68·0	27	30·0	20	1	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	63·0	28	30·0	1, 2	2	15
Tighnabruaich	*Argyll*	55 55	5 14	50	60·0	13, 14	30·0	1	2	3
Mull (Quinish)	,,	56 36	6 13	35	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	67·7	26	29·8	1	3	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	65·0	29	26·0	10	5	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	59·0	6, 7	31·5	11	3	...
Castletown	*Caithness*	58 35	3 23	100	64·0	8	34·0	2	0	7
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	67·5	29	32·0	1	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	68·0	13	33·0	10	0	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	67·0	28	32·0	9	1	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	..	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	68·9	28	35·0	10	0	1
Ballinasloe	*Galway*	53 20	8 15	160	67·2	13	28·0	10	3	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	69·0	12	32·0	1	1	4
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	65·0	12	34·0	9	0	3

RAINFALL FOR MAY, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.	Mean Annual 1870-1899.	STATION.
				in.	Date.							
in.	in.	in.		in.			in.	in.	in.		in.	
1·72	1·09	— ·63	63	·36	20	14	8·54	8·59	+ ·05	101	25·16	Camden Square
1·72	2·03	+ ·31	118	·40	20†	10	9·59	11·10	+1·51	116	28·36	Tenterden
1·86	2·49	+ ·63	134	·59	13	16	10·59	14·02	+3·43	132	29·93	West Dean
1·79	2·19	+ ·40	122	·75	8	16	9·70	10·62	+ ·92	109	27·10	Hartley Wintney
1·87	·99	— ·88	53	·24	20	15	8·37	8·65	+ ·28	103	24·66	Hitchin
2·06	1·42	— ·64	69	·27	20	15	9·29	9·32	+ ·03	100	26·75	Addington
1·85	1·48	— ·37	80	·44	20	14	8·28	10·48	+2·20	127	25·39	Westley
1·74	4·40	+2·66	253	2·46	13	16	8·23	13·78	+5·55	167	25·40	Brundall
2·02	3·73	+1·71	185	·74	23	18	14·04	19·47	+5·43	139	39·00	Winterbourne Stpltn
1·96	1·53	— ·43	78	·40	22	15	12·92	13·40	+ ·48	104	35·00	Torquay
1·98	2·30	+ ·32	116	·34	5	21	13·33	18·58	+5·25	139	38·85	Polapit Tamar
2·09	1·81	— ·28	87	·29	16	16	10·72	11·09	+ ·37	103	30·75	Bath
2·10	2·03	— ·07	97	·31	23	16	10·60	10·89	+ ·29	103	29·85	Stroud
2·62	2·08	— ·54	79	·30	2	20	11·85	11·56	— ·29	98	33·04	Woolstaston
1·94	2·08	+ ·14	107	·36	3	15	8·50	9·04	+ ·54	106	24·50	Bromsgrove
1·73	1·24	— ·49	72	·30	20	11	7·82	8·48	+ ·66	108	23·30	Boston
2·01	1·38	— ·63	69	·34	19	17	8·57	8·15	— ·42	95	24·70	Hodsock Priory
1·96	1·65	— ·31	84	·29	26	16	8·78	9·61	+ ·83	109	26·18	Derby
2·46	4·14	+1·68	168	·59	8	24	13·54	20·91	+7·37	155	42·43	Bolton
1·90	2·80	+ ·90	147	·80	19	21	9·25	10·99	+1·74	119	26·96	Ribston Hall
3·36	7·08	+3·72	211	1·05	19	23	22·78	31·27	+8·49	137	60·96	Arncliffe Vic.
1·95	1·80	— ·15	92	·55	7	16	9·12	8·53	— ·59	94	27·02	Hull
1·89	4·78	+2·89	253	1·90	19	23	9·32	11·06	+1·74	119	27·99	Newcastle
7·26	16·10	+8·84	222	3·03	25	26	50·39	58·84	+8·45	117	132·68	Seathwaite
2·55	5·06	+2·51	198	1·25	26	22	14·66	21·25	+6·59	145	42·81	Cardiff
2·53	4·88	+2·35	193	1·29	5	23	17·06	20·41	+3·35	120	47·88	Haverfordwest
2·44	4·10	+1·66	168	·80	26	23	14·66	21·15	+6·49	144	45·41	Gogerddan
1·85	3·24	+1·39	175	1·22	8	19	10·18	14·31	+4·13	141	30·98	Llandudno
2·60	7·00	+4·40	269	1·36	19	17	16·07	17·90	+1·83	111	43·43	Cargen
2·07	5·80	+3·73	280	·77	8, 19	27	11·44	12·74	+1·30	111	33·04	Riddell House
...	4·53	...	...	·58	23	21	...	11·43	...	...	...	Edinburgh
2·50	4·89	+2·39	196	1·02	19	18	16·12	17·05	+ ·93	106	44·85	Colmonell
2·36	3·92	+1·56	166	·50	27	24	12·24	16·29	+4·05	133	35·80	Glasgow
3·21	7·22	+4·01	225	1·06	28	19	20·89	29·23	+8·34	140	57·90	Tighnabruaich
2·91	4·40	+1·49	151	·72	18	19	20·29	21·49	+1·20	106	57·53	Quinish
1·88	5·00	+3·12	266	·80	24	21	9·94	9·75	— ·19	98	28·95	Dundee
2·29	5·45	+3·16	238	...	...	...	12·50	16·64	+4·14	133	36·07	Braemar
2·20	5·37	+3·17	244	1·23	16	23	11·60	13·21	+1·61	114	33·01	Aberdeen
2·03	3·41	+1·38	168	·63	8	23	9·68	13·33	+3·65	138	29·37	Cawdor
2·84	4·16	+1·32	147	·45	3	18	21·87	25·28	+3·41	116	56·00	Invergarry
5·05	7·10	+2·05	141	1·40	18	25	31·26	43·26	+12·00	138	86·50	Bendamph
2·02	4·50	+2·48	223	·85	24	18	11·31	17·77	+6·46	157	31·60	Dunrobin Castle
...	3·31	...	...	·67	31	22	...	17·20	...	...	...	Castletown
2·95	3·70	+ ·75	125	·61	2	23	22·70	19·56	—3·14	86	58·11	Killarney
2·11	3·70	+1·59	176	·53	22	16	14·58	15·40	+ ·82	106	39·30	Waterford
2·09	3·55	+1·46	170	·59	4	16	11·60	15·45	+3·85	133	33·47	Hurdlestown
2·35	2·86	+ ·51	122	·42	26	19	12·71	13·33	+ ·62	105	34·44	Carlow
1·94	2·47	+ ·53	127	·50	19	20	9·93	11·59	+1·66	117	27·75	Dublin
2·49	3·70	+1·21	149	·60	3	23	13·23	16·60	+3·37	126	37·04	Ballinasloe
4·61	5·56	+ ·95	121	·76	2	22	28·96	30·49	+1·53	105	80·23	Kylemore House
2·93	4·32	+1·39	147	·54	1	24	18·79	23·25	+4·46	124	50·50	Enniscoe
2·45	4·12	+1·67	168	·76	19	20	14·20	14·20	·00	100	38·61	Seaforde
2·48	3·22	+ ·74	130	·30	19‡	25	14·15	19·94	+5·79	141	41·20	Londonderry
2·43	4·46	+2·03	184	·61	19	26	12·98	19·58	+6·60	151	37·85	Omagh

† and 23. ‡ and 31.

SUPPLEMENTARY RAINFALL, MAY, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	1·88	XI.	Rhayader, Tyrmynydd	4·82
,,	Ramsgate, West Cliff Villas	2·60	,,	Lake Vyrnwy	...
,,	Hailsham	2·39	,,	Llangyhanfal, Plâs Draw	2·83
,,	Crowborough, Uckfield Lodge	2·72	,,	Criccieth, Talarvor	4·60
,,	Osborne, Newbarn Cottage.	1·74	,,	Llanberis, Pen-y-pass	14·99
,,	Emsworth, Redlands	2·37	,,	Lligwy	3·31
,,	Alton, Ashdell	1·73	,,	Douglas, Woodville	4·73
,,	Newbury, Welford Park	1·79	XII.	Stoneykirk, Ardwell House	5·12
III.	Harrow Weald, Hill House.	1·48	,,	Dalry, The Old Garroch	7·18
,,	Oxford, Magdalen College..	1·78	,,	Langholm, Drove Road	7·71
,,	Bloxham Grove	1·67	,,	Moniaive, Maxwelton House	6·80
,,	Pitsford, Sedgebrook	1·30	XIII.	N. Esk Reservoir [Penicuick]	5·65
,,	Huntingdon, Brampton	1·84	XIV.	Maybole, Knockdon Farm..	3·90
,,	Wisbech, Bank House	1·20	,,	Campbeltown, Witchburn	4·38
IV.	Southend Water Works	1·87	XV.	Inveraray, Newtown	4·88
,,	Colchester, Lexden	1·27	,,	Ballachulish House	5·30
,,	Newport, The Vicarage	1·08	,,	Islay, Eallabus	3·80
,,	Rendlesham	1·25	XVI.	Dollar Academy	6·39
,,	Swaffham	·83	,,	Loch Leven Sluice	6·28
,,	Blakeney	2·29	,,	Balquhidder, Stronvar	...
V.	Bishops Cannings	2·61	,,	Perth, Pitcullen House	4·71
,,	Ashburton, Druid House	3·23	,,	Coupar Angus Station	4·46
,,	Okehampton, Oaklands	2·42	,,	Blair Atholl	4·74
,,	Hartland Abbey	3·47	,,	Montrose, Sunnyside Asylum	5·17
,,	Lynmouth, Rock House	2·92	XVII.	Alford, Lynturk Manse	6·55
,,	Probus, Lamellyn	3·54	,,	Keith Station	5·61
,,	Wellington, The Avenue	2·91	XVIII.	N. Uist, Lochmaddy	2·89
,,	North Cadbury Rectory	4·70	,,	Alvey Manse	4·66
VI.	Clifton, Pembroke Road	2·56	,,	Loch Ness, Drumnadrochit.	3·46
,,	Moreton-in-Marsh, Longboro'	1·82	,,	Glencarron Lodge	5·95
,,	Ross, The Graig	1·77	,,	Fearn, Lower Pitkerrie	3·24
,,	Shifnal, Hatton Grange	2·98	XIX.	Invershin	4·76
,,	Cheadle, The Heath House.	3·18	,,	Altnaharra	4·20
,,	Coventry, Kingswood	2·34	,,	Bettyhill	4·43
VII.	Market Overton	2·90	,,	Watten Station	3·75
,,	Market Rasen	1·61	XX.	Dunmanway, The Rectory..	5·10
,,	Bawtry, Hesley Hall	1·18	,,	Cork	3·08
VIII.	Neston, Hinderton	2·15	,,	Darrynane Abbey	5·55
,,	Southport, Hesketh Park	3·41	,,	Glenam [Clonmel]	3·25
,,	Chatburn, Middlewood	5·02	,,	Ballingarry, Gurteen	3·59
,,	Cartmel, Flookburgh	6·22	,,	Miltown Malbay	4·02
IX.	Langsett Moor, Up. Midhope	3·12	XXI.	Gorey, Courtown House	2·74
,,	Scarborough, Scalby	2·72	,,	Moynalty, Westland	4·90
,,	Ingleby Greenhow	5·11	,,	Athlone, Twyford	3·79
,,	Mickleton	3·39	,,	Mullingar, Belvedere	3·83
X.	Bardon Mill, Beltingham	4·75	XXII.	Woodlawn	4·76
,,	Ewesley, Fallowlees	4·64	,,	Westport, Murrisk Abbey..	4·80
,,	Ilderton, Lilburn Cottage...	8·15	,,	Collooney, Markree Obsy..	3·59
,,	Keswick, York Bank	6·24	XXIII.	Enniskillen, Portora	3·90
XI.	Llanfrechfa Grange	3·81	,,	Warrenpoint, Summer Hill.	4·11
,,	Treherbert, Tyn-y-waun	7·89	,,	Banbridge, Milltown	4·28
,,	Carmarthen, The Friary	6·12	,,	Belfast, Springfield	4·42
,,	Castle Malgwyn [Llechryd].	3·82	,,	Bushmills, Dundarave	2·97
,,	Plynlimon	8·50	,,	Stewartstown, The Square..	4·87
,,	Tall-y-llyn	1·70	,,	Killybegs	4·74
,,	New Radnor, Ednol	2·87	,,	Horn Head	2·70

METEOROLOGICAL NOTES ON MAY, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—The R was light but fairly frequent and the weather deficient in sunshine, ten days having less than one hour each. Total duration, 124·7* hours, and duration of R 28·4 hours. The mean temp. was 54°·5, or 0°·5 above the average, but this was chiefly due to a few warm days, since for the greater part of the month cool winds kept the temp. low.

CROWBOROUGH.—Fine but changeable, warm and cold periods alternating. Mean temp. 51°·1. R ·69 in. above the average of 35 years. TS and H on 16th.

HARTLEY WINTNEY.—Cold, stormy and unsettled, with many sunless days and cold N.E. winds. Ozone every day; mean 4·3. TS on 8th.

TORQUAY.—Mean temp. 52°·5, or 0°·6 below the average. Duration of sunshine 185·1* hours. Mean amount of ozone 5·3.

WELLINGTON.—Variable, but generally cold until the last week. Very violent TS with 1·18 in. of R on 13th. R about 1·25 in. above the normal.

NORTH CADBURY.—By far the wettest May in 10 years. Terrible TS on 13th of 8 hours' duration, over nearly the whole of Somerset and much of Dorset and Wilts. There were upwards of 100 casualties from L, and in this parish cows and trees were struck.

BOLTON.—The cloudiest, wettest and most sunless May on record. Duration of sunshine 59·2* hours, or 89·1 hours below the average. Mean amount of cloud 9·2.

SOUTHPORT.—Unprecedentedly cloudy and sunless, with heavy R. Mean temp. 50°·4, or 0°·7 below the average. Duration of sunshine 111·9* hours, or 101 hours below the average and 42 hours below the previous lowest. R 1·31 in. above the average; total duration 72·4 hours.

LILBURN.—Excessive R. Heavy floods on the night of 19th caused great damage, bridges being carried away.

CARMARTHEN.—Unusually wet, cold and stormy, rendering the season generally backward. Abundant fruit blossom, but little prospect of its setting.

DOUGLAS.—Deplorably wet, stormy and cold. The R was exceeded only once in 32 years. High winds or gales occurred almost every day and sunshine was largely deficient.

LILLIESLEAF.—The wettest month registered in 20 years, the R being two and a half times the average.

COUPAR ANGUS.—The most noteworthy feature was the heavy R and the large number of rain days, being the highest in 26 years. The night temp. was high and the day temp. low, the mean being slightly below the average.

ABERDEEN.—Cold with little sunshine and the wettest month for 18 years. Agricultural work was delayed and growth checked.

DRUMNADROCHIT.—R 1·40 in., and rain days 9, above the average of 20 years, and three times exceeded in that period. There has, however, never been so cold and inclement a May.

DUNMANWAY.—The first five days, and from 22nd to 28th, were wet, but from 6th to 21st was fine and dry with cold winds.

CORK.—R ·90 in. above, and mean temp. 2°·7 below, the average.

DARRYNANE ABBEY.—The wettest May in 27 years, the R being 118·5 per cent. above the average of 25 years. There were a few fine warm days in the middle, but the rest was cold and windy.

DUBLIN.—A month in keeping with its predecessors: changeable, cloudy and cold. The mean temp. was 51°·7, or 0°·4 below the average.

OMAGH, EDENFEL.—An exceedingly raw, cold and inclement May, with an unusual preponderance of strong polar winds and R much above the average. Vegetation of all kinds was about three weeks late, but June commenced with a marked improvement.

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* Campbell-Stokes.

Climatological Table for the British Empire, December, 1905.

STATIONS. *(Those in italics are South of the Equator.)*	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	57·1	7	29·2	12	44·5	37·1	39·2	92	64·3	24·6	·74	7	7·9
Malta	66·4	6	47·0	25	62·0	51·9	50·9	85	108·6	40·6	9·10	17	5·8
Lagos	91·0	16*a*	71·0	30	88·6	75·0	74·5	76	144·0	60·0	·01	1	3·8
Cape Town	91·0	13	46·5	2	75·9	58·1	54·3	60	...	...	·67	4	3·2
Durban, Natal	90·7	18	61·6	21	81·7	67·4	...	...	154·2	...	3·01	22	6·8
Johannesburg	87·2	9	45·9	20	75·7	56·0	55·9	76	162·1	44·8	3·98	15	4·2
Mauritius	87·8	12	62·6	24	84·5	70·9	69·6	78	153·5	54·1	8·55	11	6·9
Calcutta	82·9	22	51·7	19	77·9	56·4	54·8	66	140·5	45·5	·00	0	1·5
Bombay	89·7	1	61·2	31	84·9	69·4	63·3	65	139·2	49·0	·00	0	1·3
Madras	86·2	12	59·2	10	83·5	67·2	66·0	76	135·9	54·9	·40	2	3·2
Kodaikanal	73·3	23	41·7	11	66·8	47·5	37·5	51	131·1	18·5	·02	1	3·5
Colombo, Ceylon	91·7	23	68·5	30	88·2	73·2	69·7	75	150·6	64·5	·48	4	4·5
Hongkong	80·4	11	53·4	31	69·6	62·1	59·2	80	134·0	...	2·37	8	7·3
Melbourne	98·9	18	47·0	28	72·1	53·1	52·0	74	152·1	36·0	3·18	8	5·6
Adelaide	106·0	25	45·8	5	84·1	56·7	48·9	47	165·0	42·1	·06	3	3·4
Coolgardie	105·4	16	51·6	2	93·7	63·0	52·4	40	173·6	49·0	1·20	4	3·2
Sydney	84·8	10	55·8	12	74·3	61·7	56·7	67	129·1	46·7	2·73	19	6·2
Wellington	76·2	14	41·6	25	65·1	51·6	49·6	72	132·0	35·0	2·89	13	5·0
Auckland	76·0	12	49·0	2, 25	67·9	55·8	53·7	76	139·0	41·0	2·96	11	4·0
Jamaica, Negril Point	88·1	6	67·1	22	85·7	71·2	71·1	80	...	...	1·72	5	...
Trinidad	88·0	9*b*	65·0	5*c*	85·5	68·6	71·0	81	156·0	61·0	4·16	9	...
Grenada	83·6	11	70·2	4	82·0	72·9	71·6	78	147·6	...	5·66	20	3·8
Toronto	45·9	27	6·9	15	36·8	25·7	27·8	84	59·5	2·0	2·28	11	8·0
Fredericton	54·8	3	—21·0	12	33·0	10·1	11·2	67	...	...	3·51	11	6·1
Winnipeg	35·4	10	—17·5	3	21·4	1·7	...	...	...	...	·41	7	4·9
Victoria, B.C.	50·7	18	27·8	31	46·1	39·1	...	90	...	...	2·82	18	8·1
Dawson	...	...	...	...	...	...	...	...	...	...	...	...	...

a and 17, 20, 24. *b* and 11, 28. *c* and 21, 24, 29.

MALTA.—Mean temp. of air 56°·2, or 0°·1 above average. Mean hourly velocity of wind 7·5 miles, or 3·6 below average. Mean temp. of sea 64°·5. TS8 on 3 days.

Mauritius.—Mean temp. of air 0°·8 below, of dew point 1°·9, and R 3·65 in. above, averages. Mean hourly velocity of wind 8·0 miles, or 2·8 miles below average.

MADRAS.—Bright sunshine 223·9 hours.

KODAIKANAL.—Bright sunshine 259 hours.

COLOMBO.—Mean temp. of air 79°·8, or 0°·6 above, of dew point 1°·2 below, and R 5·09 in. below averages. Mean hourly velocity of wind 10·5 miles.

HONGKONG.—Mean temp. of air 65°·3, or 2°·6 above, and R 1·34 in. above, averages. Bright sunshine 117·0 hours, or 68 hours below average. Mean hourly velocity of wind 12·9 miles.

Adelaide.—Mean temp. of air 70°·4. or 1°·0 below, and R ·80 in. below averages. Bright sunshine 23 hours above average.

Sydney.—R ·23 in. above, mean temp. 1°·9 below, and humidity 1·1 p.c. above averages.

TRINIDAD.—R ·64 in. below 40 years' average.

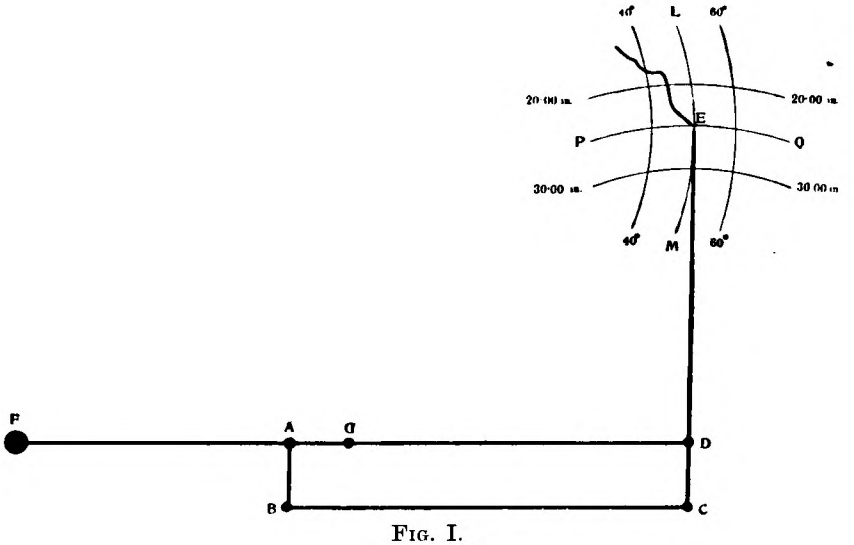


FIG. I.

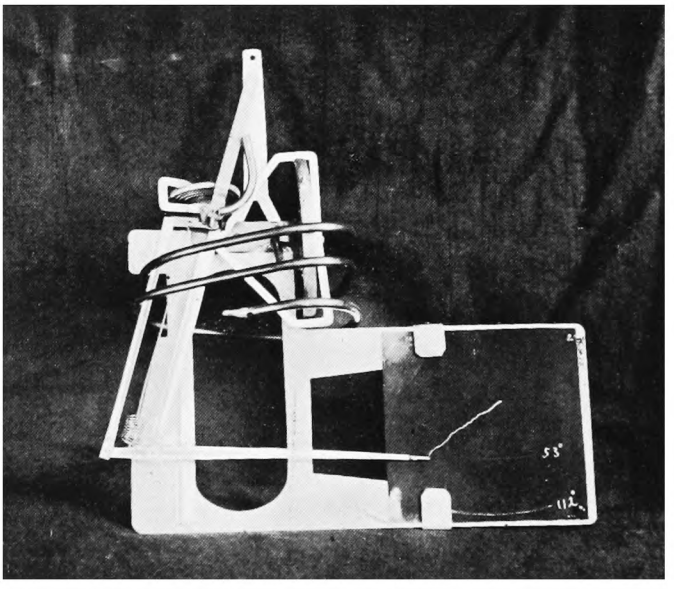


FIG. II.

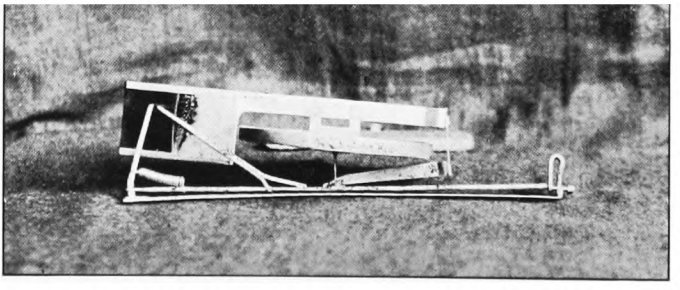


FIG. III

THE DINES' LIGHT METEOROGRAPHS.

Symons's
Meteorological Magazine.

No. 486. **JULY, 1906.** Vol. XLI.

TWO NEW LIGHT METEOROGRAPHS FOR USE WITH UNMANNED BALLOONS.

By W. H. Dines, F.R.S.

Perhaps next to accuracy, lightness is the most important characteristic of a meteorograph designed for work with small balloons, and since the clock supplies in general a fair proportion of the weight, an attempt has been made to dispense with the clock. In the heavier of these instruments, which weighs $3\frac{1}{2}$ oz. (100 grammes), the following plan is adopted. Fig. I. shows the arrangement in diagrammatic form. A, B, C, D, is a parallelogram formed of strips of thin aluminium, freely jointed at the points A, B, C and D. This is pivoted to the frame at A. The rod D A is produced to F and carries a counterpoise at F. The rod C D is continued to E, and ends at E in a turned-down sharp point, which writes on a piece of smoked aluminium and forms the record. The point G is pivoted to the face of an aneroid box, so that G moves backwards and forwards as the atmospheric pressure varies. If B remains fixed the result is that the writing point E describes the arc L M of a circle, and its position on this arc determines the pressure and hence the height. The point B is pivoted to some thermometric arrangement, so that B moves round A as the temperature varies. This causes E to move in an arc P Q and its position on P Q determines the temperature. The motions are quite independent of each other, and consequently the position of the writing point fixes both height and temperature, and the trace it makes gives the relation between them.

In the second and lighter form of instrument, which weighs 1 oz. (28 grammes), the trace is very small, but is read under a low power microscope. This plan was suggested by Dr. W. Watson some time since. The trace is given by two sharp steel points, which scratch a piece of thin metal electro-plated with copper. This plated metal is moved laterally by the extension of an aneroid box and by this motion two scratches like the lines A—B, C—D are produced. The distance between the two points which make the scratches is

regulated by the temperature, and it is quite easy under a microscope to determine the distance between the lines to 1/2000 in. (1/80mm.). Thus the distance measured along the lines gives the height, and the distance between them at that point the corresponding temperature at that height. The thermometric arrangement consists of a round steel rod and a strip of very thin aluminium, both six inches long, and their difference in length, which is multiplied up about 20 times by a lever, produces the varying distance between the scratches. The arrangement permits of the temperature being read to within about half a degree Fahrenheit, since it is not the exact position of the scratch which has to be noted but merely the distance between two scratches which lie within one or two millimetres of each other. Nickel steel, which does not vary in length, might be used, but there is an advantage in using common steel for the following reason: the round steel bar, having a small surface, in proportion to its mass, does not follow any change of air temperature as rapidly as the thin strip of the more expansible aluminium, and consequently the difference in length of the two bars before the steel has time to expand is too great, and too large a change of temperature should be indicated. But the inevitable tendency of all thermometers is to have a sensible lag, and this is to some extent compensated, so that on the whole the arrangement is more sensitive than it would be with one non-expansible metal.

Figures II. and III. are from photographs. In Fig III. the electro-plated metal has been smoked, but only for photographic purposes.

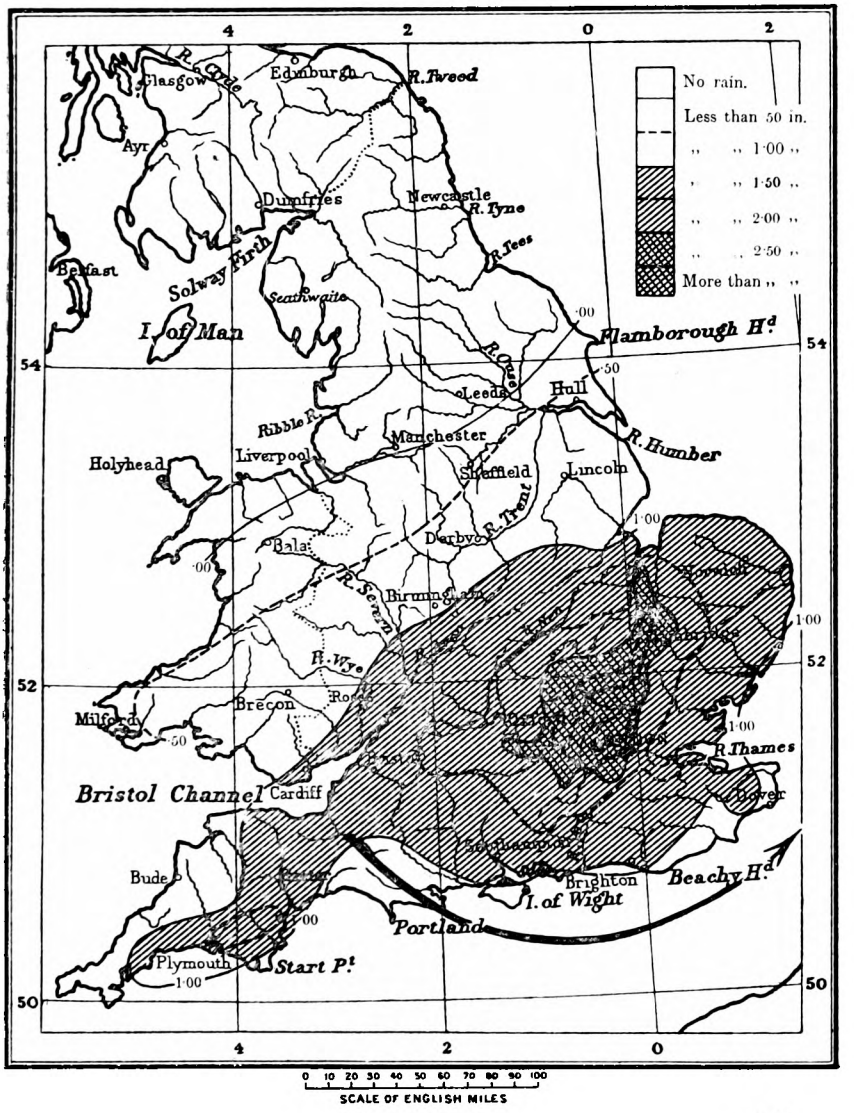
Either instrument will stand a considerable amount of shaking without blurring the trace and may be used with a kite. A hygrometric arrangement to show the humidity is easily added to either.

THE RAIN OF JUNE 28—29, 1906.

THE month of June usually abounds in interest to the student of local weather, for while it is as a rule the finest month of the year, it seldom passes without severe thunderstorms in different parts of the country. We are embarrassed on this occasion with the richness of our letter-box and have had no little trouble in endeavouring to decide what must be omitted from this number of the Magazine. Heavy summer rain is almost always associated with thunderstorms, and last June was no exception in that respect, the series of storms in the south and west of England, on the 23rd in particular, having produced some remarkable instances, with regard to which we have received many letters. But during last month a comparatively rare phenomenon occurred in the form of a heavy summer cyclonic rain, and as, in our opinion, this was the most remarkable meteorological event which calls for notice, we have discussed it in as great detail as was possible in the limited time and with the necessarily imperfect

data available. An occasion like this, when an incident of weather quite out of the common presents itself, makes us appreciate the trouble which so many observers take in forwarding their daily rainfall readings monthly, but it also makes us feel how much of that trouble is deprived of its chief value (immediate availability) by the delay of a day or two in sending it in. However, the regrets are not much in evidence on this occasion, for the returns, admirably supplemented by special reports from additional observers, were sufficiently numerous to enable us to construct a very satisfactory map, a reduction of which is here reproduced.

JUNE 28-29. 1906.



The rain commenced to fall heavily on the night of the 28th, and in London the hour was 0.27 a.m. on the 29th, while it fell steadily and continuous until 11.45 a.m. In most parts of the country affected by this rain the continuous fall stretched across the two rainfall days divided by 9 a.m. on the 29th, although in every case only a small fraction of the total fall came on the second day. In order to deal with the natural unit of the shower, or period of continuous rain, we have added together the rainfall recorded for the 28th and 29th, but though this represents a period of 48 hours practically all the rain fell in 12 consecutive hours.

When the figures are charted and the lines of equal rainfall drawn as in the accompanying map, it is seen that nearly the whole of the south of England up to a line drawn from the Bristol Channel to the Wash, an area of nearly 22,000 square miles, had received more than an inch of rain. The fall diminished rapidly from that line northwards, and stopped entirely at a line drawn from North Wales to the East Riding of Yorkshire. Within the wet area a roughly triangular patch, with its base near the lower Thames and its apex almost on the Wash, had a fall exceeding 2 inches, the base of the triangle measuring about 50 miles from Wallingford, in Berkshire, to Wallington, near Croydon, while the length of the triangle, from Woking to Wisbech, was more than 100 miles; the area with falls over 2 inches measured about 2600 square miles. The whole of this region, with over 2 inches, received in 12 hours an amount of rain equal to that which falls on the average throughout the whole month of June. Thanks to the numerous rain gauges maintained by the Metropolitan Water Board in the Lee Valley, it was possible to delineate the eastern edge of the very wet area with great exactness. It ran almost due north just to the east of the River Lee from near its mouth to Feilde's Weir, in no place entering the valley of the Roding. In the north of Middlesex and south-east of Hertfordshire there was a considerable area with more than 2·50 in. of rain, and at one point, Muswell Hill, the amount almost reached 3·00 in. A second area with more than 2·50 in. lay as a narrow strip along the Chiltern Hills from Maidenhead to Hitchin and extended thence to near Ely.

The similarity of this distribution to that of the unprecedented June cyclonic rainfall in 1903* is very striking. On that occasion the fall was continuous for nearly 60 hours and amounted to more than 4·00 in. in the wettest part, but though more prolonged it was of the same type as that now being considered. In both cases the first two days of the heavy fall were those in which a small depression passed through the English Channel, curving northwards on its eastward way with the area of heavy fall lying entirely to the left of the path. In June, 1906, the depression passed on its way over the Continent and the rain in the south of England was of short duration, whereas in 1903 the path of the depression doubled

* See this Magazine, vol. **38**, p. 97; also *British Rainfall*, 1903, p. 19.

back in a loop through England, keeping up the heavy rainfall on its left-hand side over the same area as had been deluged on its outward way.

The statement that the heavy rain was on the left-hand side of the path of a depression moving eastward, is equivalent to saying that it fell with a prevailing easterly or north-easterly wind, and this was the case on June 28th and 29th, the reduction of temperature being scarcely less remarkable than the heavy rainfall.

The following are some of the heaviest falls recorded :—

Station.	June 28th.* in.	June 29th. in.	Total. in.
Hedsor	2·66	·14	2·80
Muswell Hill	2·90	·08	2·98
Broxbourne	2·30	·40	2·70
Throcking	2·25	·25	2·50
Wendover (Halton Gardens)	2·63	·05	2·68
Ely (Stretham)	2·24	·56	2·80

THE RAINFALL OF JUNE AND OF THE FIRST HALF OF 1906.

A GREAT deal of time is spent both by Observers and Editor in preparing the elaborate table of monthly rainfall given on the last page but three of each number of this Magazine ; but, although all the facts which it is possible to put forward are set forth there in full without a superfluous letter or figure, the information is too concentrated for the taste of many readers, and it has to be diluted with a number of harmless but really unnecessary words before it can be assimilated with pleasure. June, 1906, would have been perhaps the driest month of the year but for the secondary depression referred to in the foregoing article, which deluged the country within 150 miles of the path of its centre on the left-hand side. It is only in the area of the heavy fall of June 28th--29th that the average monthly rainfall was reached, and in the heart of it, in the north of Buckinghamshire, in Bedfordshire and Cambridgeshire, the excess was more than 50 per cent. Outside a line drawn from Portland Bill through Bristol, Birmingham and Lincoln to the North Sea, the average was nowhere exceeded, and it appears that the whole of Scotland north of the Firths of Forth and Clyde and the whole north of Ireland had less than half the average rainfall, while in the north-east of Scotland only from one-third to one-quarter of the average amount was recorded. The result was that the eastern Midlands were the wettest part of the country, absolutely as well as relatively, and the Highlands and the north of Ireland were the driest.

* Most of the rain allocated to the rainfall day of June 28th really fell in the early hours of the 29th.

The effect of the June rainfall was to bring the whole country well over the average for the half year. Part of the south of Ireland, a few stations in the south-east of Scotland and a very narrow strip in the English Midlands extending from the Humber to the Severn, had just less than the average fall for the six months, but the rest of the country continued to show a moderate excess. The exceptional dryness of Scotland and Ireland in June did something to mitigate the effects of the very wet May, while in England and Wales the wetness of the south was rather more than counterbalanced by the dryness of the north. Thus the result of the six months' rainfall is to show a general excess of 16 per cent. in England and Wales, 13 per cent. in Scotland, 8 per cent. in Ireland, and 14 per cent. for the British Isles as a whole. This means that there is considerably more than a month's rainfall in hand, if one can use an expression of the counting-house in dealing with the half-unknown economy of Nature.

DR. W. N. SHAW ON THE CIRCULATION OF THE ATMOSPHERE.

(CONCLUDED.)

The fourth of Dr. Shaw's recent lectures on Meteorology, delivered at the University of London, is summarised as follows:—

IV.—Variations from normal conditions of atmospheric circulation may be studied by two distinct methods. The first, or geographical method, is that of comparing the variations of any element simultaneously at different parts of the globe, and the second that of studying the sequence of conditions over a period of time at a single locality.

Of these, the former was illustrated by curves exhibiting an obvious relation between the winter rainfall at Thorshavn (Faroe Islands) with that of the preceding summer at St. John's, Newfoundland, and that of the following summer at Berlin. The curve of barometric pressure from year to year at Bombay was shown to be conspicuously similar to those at Cordoba and Santiago inverted, indicating a reciprocal or inverse relation. Again, the seasonal variation curve of Trade-Wind velocity at St. Helena runs parallel to that for rainfall in the south of England. The Trade-Wind may be looked upon as the main artery of atmospheric circulation, and the rainfall as the direct result of that circulation.

In this connection, Dr. Shaw stated that there begin to be signs of many associations on these lines, such, for example, as Captain Lyons's discovery of the connection between Nile floods and rainfall conditions in Abyssinia, but the laws governing these correlations are at present largely matters of speculation. They, however, serve as examples of the geographical association of meteorological phenomena.

Turning to the second method, that of attempting to discover the laws governing the sequence of events in any one part of the globe, it was remarked that the effect of combined meteorological influences may be excellently summed up by observation of the wheat-crops of the British Isles. The yield of wheat is more than accidentally connected with the amount of rain falling during the previous autumn, and Dr. Shaw has made a detailed study of the conditions which precede good and bad wheat crops, with striking results. Plotting the autumn rainfall alone, the inverted curve from 1886 to 1905 follows that of the yield of wheat per acre over the Eastern Counties in almost every year, but, although the autumn rainfall is undoubtedly the predominating factor, it is not the only one. If the five best wheat crops in 20 years, with an average yield of 34·4 bushels per acre, are considered, it is found that the requisite conditions are a warm and dry autumn, a moderate or mild winter with average rainfall, a cold and rather wet spring, and a dry summer with normal temperature. The five worst years, averaging 26·3 bushels per acre, required conditions almost exactly reversed: a wet autumn, colourless as regards temperature, a cold wet winter, warm dry spring and hot summer with average rainfall.

It is a fact, not without significance, that in 16 of the 21 years considered, the departure from the average of the rainfall of the spring and the autumn of the preceding year were in opposite directions.

With regard to the periodic recurrence of meteorological conditions, the state of motion of the atmosphere, regarded as the result of the combined movements of the Earth in relation to the sun, may be considered as stable rather than unstable, that is, with a tendency to revert to a previous state in preference to diverging more widely from that state as the result of temporary disturbing influences. For this reason variations in the circulation indicate variations in the factors causing that circulation, and periodic changes in these factors would have a corresponding influence on the circulation. To become conspicuous, however, these periods must be "in tune."

By combining the sine curves of four component oscillations of respectively 1, 2, 3 and 4 wave lengths over a period of eleven years, the third curve being inverted, a resultant curve is obtained which shows a remarkable analogy with the smoothed wheat-yield curves. It is probable that wheat has a variation with a period of eleven years and perhaps a few months. This period would probably be found to relate also to rainfall, temperature, etc., but with an individual element the resemblance is apt to be masked, whereas the wheat-yield combines the effects of all.

In conclusion, Dr. Shaw reverted to the need for considering the meteorology of the British Isles as an integral part of that of the whole globe, rather than regarding this country as a separate meteorological province and studying it as such.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

COLD WEATHER AND ATLANTIC ICE.

THE coldness of the past spring has been rather freely attributed to the prevalence of ice in the North Atlantic. From a rough estimate, based on ice reports, the amount of ice in the north-western portion of that ocean during May would have stood in about the same proportion to that expanse of water as would a cube of ice with sides of 640 ft., exposed and submerged, in the western half of the English Channel, to the water in that area.

What effect could such a relatively small amount of ice have upon the temperature of land even within a radius of a quarter of a mile?

It is the cold Labrador current which lowers the temperature of the western Atlantic, the current from the north which brings the ice rather than the ice itself; and this lowering of temperature has undoubtedly its effect upon the climate of north-western Europe. But it seems probable that the cold periods which occur in this country during the months of April and May are due to the increased activity of the Greenland current, consequent upon the failure of the warm Atlantic Stream to reach, in those months, its average north-eastern limits.

To the westward of our Islands in April and in May the current usually sets to the southward or south-westward, and in the latter month the Atlantic Stream cannot be traced to a more north-easterly position than 47° N., 27° W.

This annual failure of the Atlantic Stream may be related to the fact that during February and March the average northern limit of the South-East Trade Wind lies very little north of the equator. In consequence the mean velocity of the Gulf Stream should be lower during these months than at other periods of the year and, presumably, would pour a smaller volume of warm water into the North Atlantic Ocean for some weeks immediately following.

CAMPBELL HEPWORTH.

Ealing, 26th June, 1906.

COLOUR OF LIGHTNING.

SOMERSET has recently been visited by two widespread thunderstorms of exceptional severity. The first storm, on May 13th, lasted for 8 hours. It moved slowly from S.S.W. to N.N.E., beginning here at 3.30 p.m. The thunder and lightning were continuous over the whole area for the whole 8 hours, and the casualties from lightning ran into hundreds, very impartially distributed. The rain was very unequal, almost *nil* to S. and S.W. of Yeovil, but

quite tremendous to E.N.E. of the Mendip Hills, and exceeding an inch over a large district.

The second storm, on June 23rd, moved even more slowly from W.S.W. to E.N.E. I heard thunder, continuously increasing, for three good hours before the storm broke here at 9.15 p.m. Its violence lasted till 11 p.m., and for two short spells the rain was quite exceptionally heavy. This storm, like the first, became more and more terrible as it proceeded, and it would be hard to say which was the worse of the two. But as regards the character of the lightning, the two storms were in very marked contrast.

On May 13th the lightning was *red* throughout, during the heaviest of the rain, before the rain and after it, both while it was high day and after dark. Though very terrible to see, it had little illuminating power; one could *look* at "the red-hot chains flung across the sky," and it seemed to impart its own colour to the objects lit up by it. But on June 23rd, though the lightning shewed red at 7.30, while it was yet at a distance, from the time that the storm broke here, it was of a dazzling steely *blue*. The whole sky was brilliantly lighted up by it, but there was no *looking* at this lightning. Yet all things were shewn up by its pale glare in their own colours. One had time to see and distinguish between flowers and leaves, and I noticed particularly the yellow green of my lawn.

The extreme redness of the lightning in the one case, and its blueness in the other, are noticed again and again in the many reports that I have seen of these storms. Can any explanation be given of this contrast?

H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, July 3rd, 1906.

APRIL, 1906, IN NEW SOUTH WALES.

THE month of April, 1906, possessed such abnormal temperature features in New South Wales, that a brief note may be of interest to your readers.

Unseasonably warm weather had been experienced throughout the month, and during the Easter holidays what might be termed a hot wave passed slowly over our State; its duration being most remarkable for the month of April. The following consecutive readings were recorded at the Sydney Observatory:—

April	13th.	14th.	15th.	16th.	17th.	18th.	19th.
Temp.	76°·8	79°·0	87°·2	85°·0	81°·2	88°·0	84°·6

Taking the mean temperature for the whole of this month at the Observatory, we find that all previous records, extending back to the year 1859, have been eclipsed. The mean for the month just ended was 67°·7, which is 3° in excess of the normal, and 0°·5 higher than the previous next highest mean, *i.e.*, 67°·2, which was the mean for April, 1897. Taking the average of all maximum readings, the

abnormal character of the heat becomes still more apparent. The average max. for the month just ended was 75°·8, or 4°·9 above the normal, and 1°·2 higher than the previous next highest average maximum, *i.e.*, 74°·6 in April, 1897.

Following is a table showing the means for April, 1906, compared with the result for previous years, at Sydney Observatory :—

	Mean Temp.		Mean Max.		Mean Min.
	°		°		°
April, 1906.....	67·7	...	75·8	...	59·6
Average for previous 47 years	64·7	...	70·9	...	58·3
Excess of 1906 over average for previous 47 years	3·0	...	4·9	...	1·3

Unseasonably high temperatures for this month have also been experienced in the other Australian States.

We have noticed by the cablegrams published in the Sydney daily papers that a similar heat visitation was experienced in parts of Great Britain about the same time as our heat-wave here, above noted.

H. M. HUNT, Acting Meteorologist.

Meteorological Branch, Sydney Observatory, May 3rd, 1906.

REVIEWS.

Die Niederschläge in den Norddeutschen Stromgebieten. [*Precipitation in the North German River Basins.*] *In amtlichen Auftrage bearbeitet von* PROFESSOR DR. G. HELLMANN. *In drei Bänden.* Size $10\frac{1}{2} \times 7$. Pp. Vol. **1**, vi. + 386 + (140). Vol. **2**, viii. + 722. Vol. **3**, viii. + 872. Plates. Berlin: Dietrich Reimer (Ernst Vohsen). 1906.

THIS is a remarkable and unique work, consisting of a collection of all the rainfall statistics for Germany printed in full as regards monthly totals, and accompanied by a complete discussion of the general bearing of the data. The period covered is from 1715 to 1891 and the stations are arranged according to the river basins. A map is given of the mean annual rainfall of the German Empire for the ten-year period 1893—1902, based on the records of 3000 stations. It is difficult for any one not conversant with the wearyful details of testing and discussing rainfall data of various origin, observed by different methods, to realize the amount of labour involved in the production of this monument of German Rainfall. It is easy enough to see the vast utility of the work and the extraordinary ability shown in it.

We cannot do more here than congratulate Professor Hellmann on the completion of his herculean task and refer our readers to a detailed article based on these volumes in the forthcoming issue of *British Rainfall.*

Dix Années d'Observations Météorologiques à Sèvres (Seine-et-Oise). 1892—1901. Par G. EIFFEL, avec la Collaboration de M. G. BARBÉ. Paris: 1904. Size $12\frac{1}{2} \times 9\frac{1}{2}$, pp. 96 + Atlas des Planches.

Etudes pratiques de Météorologie et Observations comparées des Stations de Beaulieu, Sèvres et Vacquey pour l'Année 1903. . . . Ibid pour l'Année 1904. . . . Par G. EIFFEL. Paris: 1905. Size $12\frac{1}{2} \times 9\frac{1}{2}$, pp. 378 and 158 + Atlas des Planches.

Types Généraux de Comparaisons Météorologiques appliqués à l'étude des Stations de Beaulieu-sur-Mer (Alpes Maritimes), Sèvres (près Paris) et Vacquey (Gironde), pour l'Année 1905 (premier Semestre). Par G. EIFFEL. Paris: 1905. Size $12\frac{1}{2} \times 9\frac{1}{2}$, pp. 72.

Les Observations Courantes en Météorologie et Comparaison des Stations de Beaulieu, Sèvres et Vacquey. Par G. EIFFEL. Paris: 1905. Size $7\frac{1}{2} \times 6\frac{1}{2}$, pp. 44.

THE eminent engineer whose name is associated with the great tower at Paris has given to his meteorological observations at three stations in France a lavish and magnificent embodiment in the series of superb volumes of text, tables and plates the titles of which are given above. Such works could only be produced by a wealthy amateur, and it is pleasant after the usual type of official publication to find so much fresh and spontaneous enthusiasm enshrined in quarto form. Our first thought is that the money expended in the preparation of these volumes might in other directions have produced a greater advancement of the science of meteorology, but probably the second thought is best, which leads us to accept gratefully the object-lesson of Weather Observations made attractive by the charm of liberal space and fine typography.

M. Eiffel strongly advocates the use of recording instruments, though in the case of rainfall he contents himself with the readings of an ordinary gauge twice daily. He groups monthly observations in three "decades," the two first of 10 days, the last of 8, 9, 10 or 11 days, according to the length of the month, preferring these 36 units to the 52 weeks in a year; he also uses the seasonal year from December to November in preference to the civil year for meteorological purposes, a reform which we would gladly see carried out if it were practicable.

ROYAL METEOROLOGICAL SOCIETY.

THE final meeting of the Session was held on Wednesday afternoon, June 20th, at the Society's Rooms, 70, Victoria Street, Westminster, Mr. Richard Bentley, President, in the chair.

Mr. F. J. Brodie read a paper on "The Mean Prevalence of Thunderstorms in various parts of the British Isles during the 25 years 1881—1905." The author employed the records from 53 stations, and extracted from them the number of days on which thunderstorms or thunder only were observed. The mean results

for the whole year showed that thunderstorms are most common over inland portions of the northern and eastern counties of England, some places in those districts experiencing between 17 and 19, and one station, Cheadle, in Staffordshire, 22. In London the average annual number is 14. Thunderstorms are least common in the south-western counties, the mean annual number at Cullompton, in Devonshire, being 6, and at Falmouth 4. At some places in the eastern parts both of Ireland and Scotland the number is 8, and locally in the west of Scotland it is even larger. On the west and south coasts of Ireland there are on the average less than 5 thunderstorms per annum, while at most places in the north of Scotland the number is smaller still. Sumburgh Head, in the Shetlands, experiences on the average only one thunderstorm a year. The results for the four seasons of the year show that in all but the winter months the distribution of thunderstorms is very similar to that exhibited by the annual averages, the prevalence being in each case greatest over the northern, eastern, and some parts of the midland counties. In the winter time the distribution is quite different. On the average none of the stations experience 3 thunderstorms in that season, and between one and two are felt only along the extreme western coasts and in the Orkneys. The winter thunderstorms occur most commonly during the passage of large cyclonic disturbances over the Atlantic in proximity to our western coasts, and are experienced at night. The monthly means for the 25 years show that over the greater part of Great Britain thunderstorms are most frequent in July. In several parts of Ireland and the west of Scotland the maximum frequency occurs in June, while in the Scilly Islands and in some parts of the west and north of England it occurs in August.

A paper by Mr. W. H. Dines, F.R.S., on "A Typical Squall at Oxshott, May 25th, 1906," was, in the absence of the author, read by the Secretary. During the morning there was a steady wind from the south-west of over 10 miles per hour until 11.0 a.m., when there was some falling off for fifteen minutes, then a rise to over 20 miles per hour, accompanied by a sudden increase of barometric pressure, and a fall of a few hundredths of an inch of rain. After the squall the wind dropped suddenly and there was almost a dead calm for about twenty minutes. The author, who was flying a kite at the time, gave some account of the changes in the wind at a considerable altitude above the ground. At 11.26 the squall struck the kite, which was then at a height of 2400 feet. Two minutes later the velocity at the kite had risen to 58 miles per hour, and the wire broke under a strain of 180 lbs. Three minutes later the kite fell at a spot 2¼ miles distant from Oxshott.

A general discussion took place on the papers read at the meeting and also on that by Mr. R. G. K. Lempfert, on "The Development and Progress of the Thunder Squall of February 8th, 1906," which was read at the previous meeting.

Mr. A. Hands, Dr. H. R. Mill, Mr. W. Marriott, Mr. J. Hopkinson, Mr. R. G. K. Lempfert, Mr. F. J. Brodie, and the President took part in the discussion.

The following gentlemen were elected Fellows of the Society, viz.: Mr. E. G. Coutts, Mr. H. T. Jackman, Mr. T. S. Sama Row, and Mr. F. W. Simms.

THE METEOROLOGY OF THE FREE ATMOSPHERE.

M. L. TEISSERENC DE BORT, Director of the Observatory for Dynamical Meteorology at Trappes, near Paris, delivered a lecture on the Meteorology of the Free Atmosphere, before the Royal Society of Edinburgh, on the afternoon of May 21st.

The lecturer said that the methods for sounding the atmosphere employed at the present day have been in our possession but a few years. The kite, carrying self-registering apparatus, was introduced by the Americans about fifteen years ago; the sounding balloon dates but twelve years back. The use of balloons, furnished with registering apparatus, was proposed by Lemonnier, a French physicist, at the end of the eighteenth century; but they were actually employed for the first time by the Fathers Renard, and especially by MM. Hermite and Besançon, whose first observations go back to 1893. Observations of great interest had already been made on mountains. To these are now added observations made in air altogether free; and these have taught us much that is new.

The lecturer in the first place discussed the distribution of the barometric pressure at a distance of several thousand metres above the ground; and showed maps in which the isobars at 4000 metres (about 2½ miles) are calculated from the pressure and temperature on the surface of the Earth. He had carefully verified the fact that the pressure in free air falls in accordance with the barometric formula. For that purpose he determined the heights of a large number of balloons by observing them with two theodolites. On the average the heights thus observed agreed with those deduced from the barometers carried by the balloons to within 2 or 3 millimetres of barometric pressure for a height of 4000 metres.

The maps of the isobars at 4000 metres show that most of the areas of high and of low pressure observed near the ground become effaced as we rise in the air, and give place to a maximum of pressure all round the Earth in the tropical regions, and low pressures at the poles. The average direction of cirrus clouds is in harmony with these conditions.

The first fact which the sounding balloons enabled the lecturer to show with regard to temperature was that, even at a height of several thousand metres above the ground, there is, contrary to what had been thought, a very sensible variation of temperature

from winter to summer; the range between the coldest and the hottest months is 16° F. at 10 kilometres (about 6 miles).

Sounding balloons despatched from the Trappes Observatory enabled the lecturer to prove that, after a certain height, varying from 9 to 14 kilometres (5 to 9 miles), the fall of temperature with height ceases altogether—another fact that was wholly unexpected. The zone where this occurs is called the "isothermal zone," and is situated, comparatively, near the ground (8 to 9 kilometres in certain places) with low pressures; but at a greater height (about 12 or 13 kilometres) above high pressure areas. As a general rule, the air is colder in the upper part of an anticyclone than it is at a corresponding height above low pressures; but the contrary holds at medium heights of about 5 kilometres. The absolutely lowest temperatures are observed near high pressures. A temperature of —99° F. has been observed several times at Trappes, and recently as low as —112° F. in Austria.

Balloon flights made daily for a week or more at a time, in different years and at different seasons, have shown that at intervals of a few days the atmosphere exhibits much greater variations of temperature high up than on the ground. At a height of 11 kilometres variations of 15° to 20° are often observed at a time when variations of only 2° to 3° are found near the ground. The lecturer believed that the arrest of the decrease of temperature is connected with the cessation at a certain height of movements of the air having a vertical component, the air then having movements which follow the isobaric surfaces. There is thus no longer any temperature variation due to expansion or compression of the air.

In conclusion, the lecturer showed how cyclones and anticyclones are transformed as we rise in the atmosphere. He demonstrated the interesting fact, proved alike by calculation of the isobars and by the flight of balloons, that most of the depressions which appear near the ground as complete atmospheric vortices suffer deformation as the height increases, and in their northern part lose themselves in the great polar vortex; so that, at a certain height (4 to 7 kilometres), east and north-east winds are no longer found to the north of a depression, and the isobars at this height form a handle attached to the low-pressure areas of northern latitudes. On the front of a depression its characters remain distinct to the top; a sheaf of ascending air reaches the height of cirrus cloud, and then spreads over the barometric maxima to east and south-east.

METEOROLOGICAL NEWS AND NOTES.

AN EARTHQUAKE SHOCK was experienced in South Wales and in various parts of the south and west of England on the morning of June 27th, and several of our correspondents have been kind enough to send particulars of their observations regarding it. On account of the pressure on our space we are unable to print these letters in the present number; and in order that the facts they contain should be put to the best use, we have forwarded them to Dr. C. Davison, of Birmingham, who is dealing fully with the matter.

MR. H. H. CLAYTON, whose work at the Blue Hill Observatory is well known to our readers, has, we learn from *Science*, accepted the position of Professor in the United States Weather Bureau at Washington.

A METEOROLOGICAL EXHIBIT FOR NEW ZEALAND, prepared by the Meteorological Office, was shown at a reception by Dr. W. N. Shaw on July 6th. An account of the exhibit will be given next month.

A METEOROLOGICAL EXHIBITION was arranged by the Royal Meteorological Society, at the request of the Council of the Royal Horticultural Society, which, realizing the great importance of the study of meteorology by those engaged in horticulture, desired to have the subject brought forward at their Great Summer Show, which was held at Holland House, Kensington, on July 11th and 12th. Mr. W. Marriott gave a short address on Meteorology in relation to Gardening, each afternoon during the Show.

RAIN-MAKING IN CANADA. — It is almost incredible that the Legislature of Yukon Territory have voted public money to supplement a popular subscription to induce a notorious "rain-maker" from California to produce rain in the Klondike region this summer. The matter has been brought up in the Dominion Parliament at Ottawa, where the facts were stated and very proper sentiments expressed. When it is so difficult to obtain a few hundred pounds for serious research in meteorology, it is exasperating to find a government within the British Empire throwing away thousands in futile experiments.

"RAIN-MAKING AND SUNSHINE" is the title of a little book which showed unconsciously how enthusiasm for a subject, apart from scientific training, may lead an intelligent mind deplorably astray. The following note is from the *Standard* of May 28th:—

The funeral took place at Shanklin, on Saturday, of Mr. John Collinson, of Delphi Cliff House, who, some time ago, gained considerable local notoriety as the "rainmaker," through his alleged power to regulate the elements, which at times caused him to be subjected to a good deal of chaff. He was the author of a book entitled "Rainmaking and Sunshine," exhaustively discoursing on odyllic force, closing with the hope that this remarkable power might, in course of time, be thoroughly understood and properly valued, and that it might be used and developed for the benefit of the British nation and British Empire.

TEMPERATURE FOR JUNE, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32° Shade.	Grass.
Camden Square	*London*	51 32	0 8	111	80·9	20	39·8	5	0	0
Tenterden	*Kent*	51 4	*0 41	190	79·0	21	38·0	5	0	0
West Dean	*Hampshire*	51 3	1 38	137	77·0	23	34·0	5	0	6
Hartley Wintney	,,	51 18	0 53	222	80·0	23	36·0	5, 6	0	...
Hitchin	*Hertfordshire*	51 57	0 17	238	...	..	...	...	...	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	79·0	20	33·0	5	0	...
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	80·0	22	35·0	5	0	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	73·5	9	36·3	6	0	1
Torquay (Cary Green)	*Devon*	50 28	3 32	12	71·2	9	44·5	30	0	0
Polapit Tamar [Launceston]	,,	50 40	4 22	315	74·9	13	37·4	30	0	0
Bath	*Somerset*	51 23	2 21	67	76·5	23	39·5	6	0	0
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	80·0	23	46·0	30	0	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	75·0	23	36·0	30	0	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	77·0	23	36·0	30	0	...
Boston	*Lincolnshire*	52 58	0 1	25	77·0	20	36·0	5	0	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	78·9	12	33·2	6	0	2
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	81·0	12	38·0	5	0	..
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	71·7	23	42·4	2	0	0
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	78·0	20	35·0	6	0	2
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	78·7	10	43·5	3	0	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	74·4	9	42·0	30	0	0
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	80·0	23	37·0	3, 18	0	...
Llandudno	*Carnarvon*	53 20	3 50	72	75·0	23	46·2	1	0	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	80·0	12	40·0	30	0	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	75·0	9	37·0	4	0	...
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	75·1	12	41·8	5	0	0
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	76·0	11	38·0	3	0	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	76·0	11	41·0	3	0	1
Tighnabruaich	*Argyll*	55 55	5 14	50	72·0	11	36·0	3	0	0
Mull (Quinish)	,,	56 36	6 13	35	63·0	23	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	83·1	12	36·7	29	0	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	77·0	19	43·0	4	0	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	70·0	21	34·0	29	0	0
Castletown	*Caithness*	58 35	3 23	100	73·0	19, 21	41·0	2, 18	0	...
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	78·5	11	40·0	4	0	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	76·0	9	40·0	4	0	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	74·0	10, 11	38·0	29	0	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	76·2	21	42·7	30	0	0
Ballinasloe	*Galway*	53 20	8 15	160	76·3	9	33·0	30	0	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	81·0	8, 10	41·0	4, 29	0	0
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	..	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	78·0	11	36·0	29	0	1

RAINFALL FOR JUNE, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.	Mean Annual 1870-1899.	STATION.
in.	in.	in.		in.	Date.		in.	in.	in.		in.	
2·09	2·89	+ ·80	138	2·21	28	8	10·63	11·48	+ ·85	108	25·16	Camden Square
1·96	1·19	— ·77	61	·33	28	8	11·55	12·29	+ ·74	106	28·36	Tenterden
2·02	22·1	+ ·19	109	·89	28	6	12·61	16·23	+3·62	129	29·93	West Dean
1·89	2·07	+ ·18	110	1·38	28	7	11·59	12·69	+1·10	109	27·10	HartleyWintney
1·89	...	...	...	...	...	...	10·26	..	...	...	24·66	Hitchin
1·99	3·68	+1·69	185	2·02	28	9	11·28	13·00	+1·72	115	26·75	Addington
2·04	3·37	+1·33	165	1·46	28	9	10·32	13·85	+3·53	134	25·39	Westley
1·89	2·00	+ ·11	106	·75	28	15	10·12	15·78	+5·66	156	25·40	Brundall
2·32	1·71	— ·61	74	·94	28	7	16·36	21·18	+4·82	129	39·00	Winterbourne Stplton
2·13	1·96	— ·17	92	1·28	28	7	15·05	15·36	+ ·31	102	35·00	Torquay
2·12	1·49	— ·63	70	·94	28	8	15·45	20·07	+4·62	130	38·85	Polapit Tamar
2·31	2·64	+ ·33	114	1·10	28	7	13·03	13·73	+ ·70	105	30·75	Bath
2·23	2·59	+ ·36	116	1·15	28	11	12·83	13·48	+ ·65	105	29·85	Stroud
2·46	2·14	— ·32	87	·56	16†	10	14·31	13·70	— ·61	96	33·04	Woolstaston
2·07	3·07	+1·00	148	·77	28	8	10·57	12·11	+1·54	115	24·50	Bromsgrove
1·94	2·33	+ ·39	120	·75	28	12	9·76	10·81	+1·05	111	23·30	Boston
2·24	2·15	— ·09	96	·72	28	10	10·81	10·30	— ·51	95	24·70	Hodsock Priory
2·70	2·04	— ·66	76	·54	28	11	11·48	11·65	+ ·17	101	26·18	Derby
3·21	1·86	—1·35	58	·33	1	13	16·75	22·77	+6·02	136	42·43	Bolton
2·38	·95	—1·43	40	·50	23	7	11·63	11·94	+ ·31	103	26·96	Ribston Hall
3·69	2·88	— ·81	78	·89	12	12	26·47	34·15	+7·68	129	60·96	Arncliffe Vic.
2·12	1·78	— ·34	84	·75	21	12	11·24	10·31	— ·93	92	27·02	Hull
2·03	1·86	— ·17	92	·55	16	12	11·35	12·92	+1·57	114	27·99	Newcastle
6·97	4·61	—2·36	66	2·61	26	10	57·36	63·45	+6·09	111	132·68	Seathwaite
2·53	2·33	— ·20	92	·90	28	11	17·19	23·58	+6·39	137	42·81	Cardiff
2·61	2·42	— ·19	93	·78	27	10	19·67	22·83	+3·16	116	47·88	Haverfordwest
2·93	2·89	— ·04	99	·70	23	14	17·59	24·04	+6·45	137	45·41	Gogerddan
2·00	1·41	— ·59	70	·62	26	9	12·18	15·72	+3·54	129	30·98	Llandudno
2·68	2·08	— ·60	78	·62	23	8	18·75	19·98	+1·23	107	43·43	Cargen
2·44	1·71	— ·73	70	·33	16	11	13·88	14·45	+ ·57	104	33·04	Riddell House
...	1·50	...	...	·86	21	8	...	12·93	...	...	...	Edinburgh
2·71	1·70	—1·01	63	·57	21	8	18·83	18·75	— ·08	100	44·85	Colmonell
2·70	1·61	—1·09	60	·32	17	13	14·94	17·90	+2·96	120	35·80	Glasgow
3·76	2·20	—1·56	59	·83	20	10	24·65	31·43	+6·78	128	57·90	Tighnabruaich
3·55	1·30	—2·25	37	·38	24	13	23·84	22·79	—1·05	96	57·53	Quinish
2·15	1·10	—1·05	51	·20	21	13	12·09	10·85	—1·24	90	28·95	Dundee
2·44	·77	—1·67	32	...	...	...	14·94	17·41	+2·47	117	36·07	Braemar
2·09	·74	—1·35	35	·17	30	13	13·69	13·95	+ ·26	102	33·01	Aberdeen
2·24	·80	—1·44	36	·28	30	13	11·92	14·13	+2·21	119	29·37	Cawdor
2·85	1·17	—1·68	41	·45	30	4	24·72	26·45	+1·73	107	56·00	Invergarry
4·78	2·22	—2·56	46	·37	26	13	36·04	45·48	+9·44	126	86·50	Bendamph
2·14	·53	—1·61	25	·11	21‡	7	13·45	18·30	+4·85	136	31·60	Dunrobin Castle
...	·99	...	...	·20	27	11	...	18·19	...	...	...	Castletown
3·29	3·36	+ ·07	102	1·31	17	11	25·99	22·79	+3·20	88	58·11	Killarney
2·61	1·46	—1·15	56	·44	23	14	17·19	16·86	— ·33	98	39·30	Waterford
2·52	2·51	— ·01	100	·74	17	15	14·12	17·96	+3·84	127	33·47	Hurdlestown
2·32	1·40	— ·92	60	·39	23	12	15·03	14·73	— ·30	98	34·44	Carlow
1·95	1·05	— ·90	54	·17	21	12	11·88	12·64	+ ·76	106	27·75	Dublin
2·69	2·05	— ·64	76	·40	30	14	15·92	18·65	+2·73	117	37·04	Ballinasloe
5·33	4·29	—1·04	80	1·04	17	7	34·29	34·78	+ ·49	101	80·23	Kylemore House
2·95	2·44	— ·51	83	·45	17	13	21·74	25·69	+3·95	118	50·50	Enniscoe
2·72	1·23	—1·49	45	·21	16	14	16·92	15·43	—1·49	91	38·61	Seaforde
2·92	1·08	—1·84	37	·24	19	14	17·07	21·02	+3·95	123	41·20	Londonderry
2·88	·91	—1·97	32	·30	24	9	15·86	20·49	+4·63	129	37·85	Omagh

† and 28. ‡ and 30.

SUPPLEMENTARY RAINFALL, JUNE, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	2·26	XI.	Rhayader, Tyrmynydd	3·03
,,	Ramsgate, West Cliff Villas	1·61	,,	Lake Vyrnwy	1·91
,,	Hailsham	1·35	,,	Llangyhanfal, Plâs Draw	1·14
,,	Crowborough, Uckfield Lodge	2·73	,,	Criccieth, Talarvor	2·22
,,	Osborne, Newbarn Cottage.	1·37	,,	Llanberis, Pen-y-pass	1·85
,,	Emsworth, Redlands	1·60	,,	Lligwy	1·44
,,	Alton, Ashdell	2·18	,,	Douglas, Woodville	1·14
,,	Newbury, Welford Park	3·03	XII.	Stoneykirk, Ardwell House	1·68
III.	Harrow Weald, Hill House.	2·98	,,	Dalry, The Old Garroch	1·64
,,	Oxford, Magdalen College..	2·84	,,	Langholm, Drove Road	2·10
,,	Bloxham Grove	3·25	,,	Moniaive, Maxwelton House	1·80
,,	Pitsford, Sedgebrook	3·81	XIII.	N. Esk Reservoir [Penicuick]	1·65
,,	Huntingdon, Brampton	3·49	XIV.	Maybole, Knockdon Farm..	1·39
,,	Wisbech, Bank House	3·23	XV.	Campbeltown, Witchburn	1·73
IV.	Southend Water Works	2·12	,,	Inveraray, Newtown	1·55
,,	Colchester, Lexden	1·73	,,	Ballachulish House	1·68
,,	Newport, The Vicarage	2·96	,,	Islay, Eallabus	1·30
,,	Rendlesham	1·93	XVI.	Dollar Academy	1·80
,,	Swaffham	2·82	,,	Loch Leven Sluice	1·67
,,	Blakeney	1·89	,,	Balquhidder, Stronvar	1·09
V.	Bishops Cannings	3·06	,,	Perth, Pitcullen House	1·30
,,	Ashburton, Druid House	2·61	,,	Coupar Angus Station	1·27
,,	Okehampton, Oaklands	1·54	,,	Blair Atholl	·58
,,	Hartland Abbey	1·32	,,	Montrose, Sunnyside Asylum	·77
,,	Lynmouth, Rock House	2·31	XVII.	Alford, Lynturk Manse	·60
,,	Probus, Lamellyn	1·55	,,	Keith Station	1·61
,,	Wellington, The Avenue	2·32	XVIII.	N. Uist, Lochmaddy	1·21
,,	North Cadbury Rectory	2·15	,,	Alvey Manse	·88
VI.	Clifton, Pembroke Road	2·74	,,	Loch Ness, Drumnadrochit.	1·09
,,	Moreton-in-Marsh, Longboro'	3·46	,,	Glencarron Lodge	2·71
,,	Ross, The Graig	3·09	,,	Fearn, Lower Pitkerrie	·32
,,	Shifnal, Hatton Grange	2·36	XIX.	Invershin	·63
,,	Cheadle, The Heath House.	1·97	,,	Altnaharra	·93
,,	Coventry, Kingswood	3·28	,,	Bettyhill	1·04
VII.	Market Overton	2·98	,,	Watten Station	·33
,,	Market Rasen	1·55	XX.	Dunmanway, The Rectory..	3·17
,,	Bawtry, Hesley Hall	1·82	,,	Cork	1·62
VIII.	Neston, Hinderton	1·21	,,	Darrynane Abbey	4·28
,,	Southport, Hesketh Park	1·67	,,	Glenam [Clonmel]	1·45
,,	Chatburn, Middlewood	1·75	,,	Ballingarry, Gurteen	2·12
,,	Cartmel, Flookburgh	3·02	,,	Miltown Malbay	2·71
IX.	Langsett Moor, Up. Midhope	1·63	XXI.	Gorey, Courtown House	1·65
,,	Scarborough, Scalby	·58	,,	Moynalty, Westland	2·13
,,	Ingleby Greenhow	1·05	,,	Athlone, Twyford	1·95
,,	Mickleton	·67	,,	Mullingar, Belvedere	2·22
X.	Bardon Mill, Beltingham	1·93	XXII.	Woodlawn	3·57
,,	Ewesley, Fallowlees	2·20	,,	Westport, Murrisk Abbey..	3·09
,,	Ilderton, Lilburn Cottage	1·66	,,	Collooney, Markree Obsy..	2·38
,,	Keswick, York Bank	1·77	XXIII.	Enniskillen, Portora	·84
XI.	Llanfrechfa Grange	3·37	,,	Warrenpoint, Summer Hill.	...
,,	Treherbert, Tyn-y-waun	3·27	,,	Banbridge, Milltown	1·02
,,	Carmarthen, The Friary	2·75	,,	Belfast, Springfield	1·31
,,	Castle Malgwyn [Llechryd].	1·76	,,	Bushmills, Dundarave	1·28
,,	Plynlimon	4·00	,,	Stewartstown, The Square..	1·30
,,	Tall-y-llyn	1·00	,,	Killybegs	1·77
,,	New Radnor, Ednol	2·00	,,	Horn Head	1·78

METEOROLOGICAL NOTES ON JUNE, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Fine, with equable temp., except for short cold periods on 1st and 2nd, and 13th to 15th. Mean temp. 60°·1, or 0°·3 below the average; the mean temp. exceeded 70° on 22nd only. Of the R 76 per cent. took place on the night of 28th and morning of 29th. Moderate T showers on 16th and 23rd. Duration of sunshine 216·1,* and of R 16·8, hours.

CROWBOROUGH.—Fine and warm with considerable sunshine. TSS on 1st, 24th and 29th. R ·26 in. above the average of 35 years. Mean temp. 56°·8.

HARTLEY WINTNEY. — Uninterrupted summerlike weather prevailed throughout, but the heavy R of 28th was followed by cold wind and fall of temp. TSS on 16th and 23rd. Ozone on 9 days; mean 3·1.

ADDINGTON MANOR.—Heavy TSS on 16th and 24th, when seven sheep and two bullocks were killed by L. The R of 28th was the largest in 24 hours since July 17th, 1890, when 2·20 in. fell. Low temp. on 5th, 6th and 30th.

BURY ST. EDMUNDS.—Dry till 25th, with cold nights till 22nd. Heavy cold R on 28th and 29th, measuring 1·94 in. in 12 hours.

TORQUAY.—Duration of sunshine 261·9* hours, or 34·5 hours above the average. Mean temp. 58°·0, or 0°·7 below the average. Mean amount of ozone 4·6.

NORTH CADBURY RECTORY.—Delightful from 2nd to 23rd, but the last week was cool, cloudy and damp. TS on 23rd and long slow R on 28th.

CLIFTON.—After a cold day with TS on 1st, it was fine and warm till 13th with easterly winds; then rainy and cold till 17th, with TS on 16th. The rest was warmer but unsettled; TS on 23rd and about 30 hours continuous R on 27th and 28th. R ·30 in. above the average.

BOLTON.—Bright and sunny, but duration only 140·4* hours, or 17·8 hours below the average. Mean bar. the highest since 1887. Heavy hay crop.

SOUTHPORT.—Remarkably high and steady bar., but singularly normal in nearly all other respects. Mean temp. 57°·3, equal to the average. R ·49 in. below the average. Duration of sunshine 225·1* hours, or 4·9 hours above the average. Duration of R 29·5 hours. TSS on 12th, 22nd and 23rd.

CARMARTHEN.—Delightful summer weather till 13th, but afterwards cold, wet and dull to the end. TS on 23rd. Earthquake at 9.48 a.m. on 27th.

HAVERFORDWEST.—Fine and warm with low night temp. and considerable R. Duration of sunshine 222·1* hours. Agricultural operations were backward, but crops good. TS on 23rd. Earthquake on 27th.

MULL.—The lack of R did less harm than the dry weather of June, 1905. This month the temp. was much lower and heavy dews and sea fogs were frequent. Never have crops and foliage looked better.

COUPAR ANGUS.—R a little short of the average, but well distributed. Mean temp. 57°·8, the highest in 26 years. Remarkably steady bar.

DUNMANWAY.—The first 16 days were very fine and bright, and warmer than usual. After 16th there was heavy R at night and showers during the day, but it was still warm, except on the last three days.

DARRYNANE ABBEY.—Fine and hot to 16th, but thence almost constant R and fog to 27th. Total R 23 per cent. over the average.

WATERFORD.—The first half was dry, but in the latter part R fell nearly every day. The total was, however, the least since 1889. Mean temp. 58°·0.

MILTOWN MALBAY.—The first half was warm and sunny with great growth of vegetation. The second half, opening with a TS, had R to the end.

DUBLIN.—Fine with high bar. and marked prevalence of polar winds. The second half was showery. Mean temp. 59°·1, or 1°·6 above the average.

OMAGH.—As a rule the month was dry with a considerable preponderance of polar winds, producing on 29th a mean temp. of 46°, a point never before reached so late in June during 40 years. Crops, however, suffered but little.

* Campbell-Stokes.

Climatological Table for the British Empire, January, 1906.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	53·0	26	25·3	23	47·3	36·4	39·2	90	79·0	22·1	4·02	18	6·3
Malta	67·2	5	42·8	24	59·6	49·6	48·6	82	111·0	37·7	4·48	18	5·8
Lagos	91·0	6*a*	66·0	11*b*	88·0	73·4	71·3	71	135·0	54·5	1·04	2	0·7
Cape Town	85·8	21	51·7	18	76·7	59·1	57·2	70	...	...	·39	7	3·4
Durban, Natal	97·2	11	62·8	25	86·1	70·4	...	...	154·8	...	2·35	16	6·1
Johannesburg	87·2	21	51·7	26	78·9	58·2	59·0	76	162·1	51·8	3·80	12	3·6
Mauritius	89·6	21	65·7	6	86·1	72·6	70·2	76	152·1	58·9	3·42	13	6·5
Calcutta	81·9	28	46·3	17	75·9	55·8	55·2	68	144·0	40·2	1·78	1	3·5
Bombay	89·0	18	60·1	2	82·1	66·6	61·9	67	136·6	49·0	·00	0	1·3
Madras	86·8	10	65·1	1	83·9	69·5	69·0	80	138·2	60·9	4·05	5	4·8
Kodaikanal	73·3	1	41·9	13	64·8	48·1	45·0	70	137·3	22·6	4·10	5	3·4
Colombo, Ceylon	89·6	20	69·2	3	87·4	73·4	71·0	77	156·0	63·0	6·29	9	3·9
Hongkong	72·8	10	46·8	2	62·5	54·8	52·5	80	123·0	...	1·99	10	8·0
Melbourne	109·6	23	45·2	2	81·6	56·7	53·0	59	165·8	37·2	·37	4	4·6
Adelaide	113·1	5	51·9	27	92·4	64·4	52·7	41	165·3	45·0	·00	0	2·4
Coolgardie	113·0	18	54·4	11	96·2	66·6	52·4	37	176·0	51·2	·41	2	3·1
Sydney	91·0	24	58·0	16	77·9	64·3	61·2	69	135·4	52·5	2·21	16	5·8
Wellington	75·0	20	45·0	17	66·5	53·8	51·3	72	138·0	40·0	4·93	9	5·9
Auckland	76·0	14	52·0	3, 24	69·1	56·3	53·5	72	140·0	45·0	1·17	7	4·5
Jamaica, Negril Point	89·0	6	64·0	25	84·2	68·2	68·4	79	...	...	4·22	8	...
Trinidad	89·0	16	63 0	16*c*	82·5	64·4	67·7	77	155·0	59·0	·43	6	...
Grenada	87·0	29	69·0	26	82·0	72·0	68·6	72	149·0	...	2·02	13	2·6
Toronto	56·1	22	4·4	8	36·9	24·4	26·0	82	67·5	0·0	1·75	15	7·0
Fredericton	49·8	23	—10·7	11	34·0	10·2	8·7	63	...	...	4·04	9	5·6
Winnipeg	38·5	27	—35·5	23	17·0	—3·3	...	...	...	...	1·33	10	4·2
Victoria, B.C.	53·1	25	26·2	20	45·1	38·0	...	...	...	...	2·56	21	8·9
Dawson	18·0	31	—65·5	24	-27·1	—40·7	...	...	...	...	1·26	10	4·9

a and 21, 26. *b* and 12. *c* and 21.

MALTA.—Mean temp. of air 54°·4, or 1°·3 above average. Mean hourly velocity of wind 10·3 miles, or 1·0 below average. Mean temp. of sea 60°·0.

Durban, Natal.—R 2·39 in. below average.

Mauritius.—Mean temp. of air 0°·3 below, dew point equal, and R 4·36 in. below, averages. Mean hourly velocity of wind 9·9 miles, or 1·2 below average.

MADRAS.—R 4·05 in. the heaviest rainfall in January since 1870; TS on 17th, and distant T on 16th and 18th.

KODAIKANAL.—Bright sunshine 217 hours.

COLOMBO.—Mean temp. of air 79°·9, or 0°·8 above, of dew point 1°·0 above, and R 2·66 in. above, averages. Mean hourly velocity of wind 8·4 miles.

HONGKONG.—Mean temp. of air 58°·4. Mean direction of wind E. by N., and mean hourly velocity 12·7 miles. Bright sunshine 86·8 hours.

Adelaide.—Mean temp. of air 4°·4 above average. Dry and very hot month.

Sydney.—R 1·29 in. below, mean temp. 0°·4 below, and humidity 2·1 below, averages.

Wellington.—Mean temp. 2°·7 below, and R 1·50 in. above, averages.

TRINIDAD.—R 2·49 in. below 43 years' average.

Symons's

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METEOROLOGY AT THE BRITISH ASSOCIATION.

The British Association for the Advancement of Science held its seventy-sixth annual meeting at York, the city where it met for the first time, and where the Jubilee Meeting was held in 1881. Few towns possess such advantages as York for a meeting of the kind, and the local arrangements both for scientific gatherings and social functions were admirably made. An innovation which was much appreciated was an informal tea-party held every afternoon in the Museum Gardens of the Yorkshire Philosophical Society by the President of that Society, Dr. Tempest Anderson. These gardens contain a well-equipped meteorological station maintained by the Society, the position of which is perfectly adapted for giving a correct record of the climate of York.

Although there was a meeting of the department of Section A for Astronomy and Cosmical Physics, it was not organized this year as a sub-section, with a Chairman, and we cannot but regret the languid interest which continues to be shown by the British Association in Meteorology, and the utterly inadequate time allotted to meteorological papers. It is unfortunate that the few meteorological papers presented to the Association had been announced so late that no abstracts were available for distribution, and useful discussion was thus impossible.

The gathering of meteorologists at the meeting was more remarkable for those who were absent than for those who were present, and yet, considering the opportunities which such a meeting affords for the encouragement and stimulation of observers by contact with the leading exponents of meteorological science, we should naturally expect that some effort would be made by the official Meteorological establishments, to whom all the public money voted for meteorology in this country is confided, to take advantage of them.

The only attempt to bring together those specially interested in the study of atmospheric phenomena was in the Meteorological Breakfast, a spontaneous gathering of meteorological observers and students.

The Breakfast was held in Terry's Restaurant, on Monday, 6th August, at 9 a.m., and for the first time lady-observers were present.

There was no chairman and no formality, the object being to promote the mutual acquaintance of observers and meteorologists from all parts of the country who have no other opportunity of meeting. It was mentioned that at the previous York meeting in 1881, Mr. Symons held the last of the first series of these breakfasts, which, except for the breakfast given by Dr. Buchan in Edinburgh, in 1892, were not resumed until the first year of the present century, but have since been kept up at Glasgow, Belfast, Southport, Cambridge, Capetown, and now at York. The following is the list of the twenty-eight persons in the order in which their names were signed on entering the room :—

Alfred Colson	Leicester.
Herbert Ellis	Leicester.
John Woodrow	Paisley (Coats Observatory).
Dr. W. S. Black	Edinburgh.
John Smyth, C.E.	Banbridge.
Mrs. D. D. MacKinnon	Speldhurst, Kent.
Patrick Y. Alexander	Portsmouth.
John Bolton	London.
Dr. H. R. Mill	London.
Arthur R. Hinks	Cambridge Observatory.
Col. A. C. Bigg-Wither	Godalming.
W. E. Plummer	Liverpool (Bidston Observatory).
Edward Kitto	Falmouth Observatory.
P. F. S. Amery	Ashburton.
J. Smith	Crathes.
James Murray	Edinburgh.
H. Yule Oldham	Cambridge.
A. Macdonald	Durris, Aberdeenshire.
J. Edmund Clark	Purley, Surrey.
James Kewley	Isle of Man.
Dr. A. J. Herbertson	Oxford.
Mrs. H. R. Mill	Mill Hill, N.W.
Miss Rich	Roedean, Brighton.
Dr. W. J. S. Lockyer	London.
Dr. J. R. Ashworth	Rochdale.
R. S. Kennedy, C.E.	London.
R. Cockburn Millar	Edinburgh.
E. P. Frost	Cambridge.

Later in the day the following papers were taken in Section A :—

Report of Kites Committee.

Prof. A. Schuster, F.R.S., and Prof. H. H. Turner, F.R.S. *Note on Rainfall.*

Miss C. O. Stevens.—*Telescopic Observations of Meteorological Phenomena.*

J. E. Clark.—*The York Rainfall.*

Dr. W. J. S. Lockyer.—*Some Barometric and Rainfall Changes of an oscillatory nature.*

Report of Falmouth Observatory Committee.

Report of the Ben Nevis Committee.

These papers, which would have more than filled a day by themselves, were crowded in one day's proceedings along with eight other

papers, one of them a discussion on Radioactivity and the internal structure of the Earth, in which six gentlemen were announced as expected to take part! It is to our mind absurd to overcrowd sections in this way, and it would be far better if the Organizing Committee freely exercised its right of rejecting offered papers, so as to retain no more than can be dealt with fairly in the time allotted.

Apart from the sectional proceedings at the Association, an important place is held by the Conference of Delegates from Affiliated and Associated Societies in all parts of the British Empire. Two meetings of this Conference are held, and the first—at the request of the Committee on Corresponding Societies (President, Sir Edward Brabrook, C.B.; Secretary, Mr. F. W. Rudler, I.S.O.)—an address was given on Local Scientific Societies and Meteorology.

LOCAL SOCIETIES AND METEOROLOGY.*

THE purpose of Scientific Societies is twofold, to advance science and to secure to the members the intellectual advantages which accrue from scientific study. The two aims are inseparable, but one or the other preponderates according to circumstances. While it is evident that a Society devoted exclusively to botany, or to entomology, must look for any development to the wider, or deeper study of the appropriate science, it is no less clear that a field club or local scientific association of a more general kind may be improved by the development of a department hitherto neglected or ignored, and it is to the representatives of societies of the latter category that my remarks are specially addressed. Such societies may be assumed to occupy the mean position in which the advancement of science and the intellectual advantages to the members are blended as equal aims. For the consideration of such societies I would direct attention on this occasion to Meteorology.

It has been suggested at an earlier meeting of this Association that it would be a good thing if all meteorological observations were stopped for a time, and the whole intellectual powers of the observers concentrated on the discussion of a specific problem. This was probably merely a strong way of saying that the aimless reading of instruments and the heaping up of records that are never discussed, are useless and harmful, and in so far I fully agree with it. But I think that meteorology can be advanced best by increasing rather than diminishing the number of observations; though only by insisting that these observations are well-planned and well carried out, mixed, in fact, "with brains."

Meteorology is the science of the atmosphere, as regards its movements and the conditions which bring about those movements. It

* Address given to the Conference of Delegates of Corresponding Societies, at the meeting of the British Association at York, by Dr. H. R. Mill.

is not keeping a record of the weather, though that is a necessary part of it, for the central aim of meteorology as a science is to discover the cause and trace the order of those changes which together constitute the weather. It is convenient for the ordinary affairs of life to be able to know in the morning, or the day before, what the weather is going to be, but the sailor or shepherd acquires this power by experience and tradition in a higher degree than a student of meteorology is likely to gain by reading text books, or even an isolated set of instruments.

So far as we can see weather forecasts must always depend on the study of the conditions prevailing simultaneously over a wide area of the Earth's surface, and of the changes these conditions undergo from hour to hour. Such knowledge can only be obtained by government establishments, maintained at great cost, and in telegraphic touch with a far-flung network of stations, reaching beyond our islands on every side. I do not hold out any promise of skill in weather forecasting as a reward for the study of meteorology, but I am sure that the existing weather forecasts would be improved if a large and intelligent public criticism were brought to bear on them. Criticism of the wrong kind abounds; no journalist is too young to fling a gibe at "the Clerk of the Weather;" hundreds of hasty enthusiasts are ready to declare that they could do better themselves. Amongst scientific paradoxers—circle-squarers, Earth-flatteners, perpetual-motionists, and all their kind—I really believe that the worst eminence is held by the weather-cycle-mongers, whose name is legion, for they are many. There is no cure for meteorological fads except the study of meteorological facts, and in the interest of common sense and sane judgment I strongly urge the serious study of meteorology on all who are attracted towards natural science. Sympathetic criticism by students who have taken the trouble to master the principles of weather forecasting, cannot fail to be helpful.

My first advice is never to start meteorological observations with cheap instruments. Enthusiastic weather observers frequently write me wanting to know where they can get a cheap set with which to observe, and my advice is always to wait until they can afford good instruments guaranteed by an official certificate. Imperfect or untrustworthy records are of no value whatever for any purpose. One year's observations are of little value, but they involve a considerable expenditure of time; but a thirty years' record is worth a great deal, and many observers have done as much. Such a record represents some 3000 hours' work, and an observer's time is worth little if it does not represent at least £150. It could easily be made with one set of instruments, and my argument is that it is false economy to render £150 worth of honest work absolutely useless for the sake of saving £5 in the initial cost of equipment. Yet again and again I have met people to whom a few pounds is neither here nor there, who prefer to save five shillings by buying an inferior instrument the record of which is not worth

the time they squander in reading it. It seems to me to be a matter eminently worthy the attention of the delegates whether they will make their societies centres of real scientific work by seeing that however little is done, that little is done well and with appliances that are worth expending time upon.

There is scope in meteorology for a great diversity of useful work suited for various tastes and aptitudes, requiring much or little in the way of equipment. There are some special problems which can only be profitably attacked by trained students. Of these perhaps the most attractive is the study of the conditions of the free atmosphere by means of kites or balloons carrying automatically recording instruments. It is in this department that most advance is now being made, and it promises important developments in meteorological theory. The methods have been developed largely by Mr. W. H. Dines, acting in conjunction with a joint Committee of the British Association and the Royal Meteorological Society, and it would be extremely desirable for the work to be extended. The requisites are a few meteorographs, some powerful kites, several miles of steel wire on which to fly them, and a suitable winding machine with a steam engine for drawing in the kites and controlling their movements. It is absolutely necessary for high flights that the experiments be carried on far from the haunts of men, as if a kite with a couple of miles of steel wire attached were to fall or to break away, disastrous results might follow if there were railways or highroads in its track. Kite work requires an initial expenditure of at least £150, and demands a good deal of mechanical skill as well as scientific enthusiasm on the part of the investigator.

Researches on hygrometry, the condition of the atmosphere as regards water-vapour, are also desirable. For this a good deal could be done with simple means, for the subject remains in a very unsatisfactory state. The relation of the wet and dry bulb thermometer to the hair hygrometer and other direct reading instruments wants to be more fully investigated. The variations of humidity at every hour of the twenty-four wants to be determined for a number of stations in different climates, and the tables for the reduction of the various instrumental readings want to be revised. Success in this research demands some knowledge of physics and mathematics.

The study of local climate may perhaps prove more attractive. Vast masses of observations have been accumulated which have never been utilized and never can be; but this is no reason for ceasing to make observations, quite the reverse. It is extremely desirable that every town of importance should have at least one well-equipped and properly conducted meteorological station. Such stations are maintained as a rule by individuals, though they are sometimes supported by corporations or local authorities, and it seems to me that it would be extremely appropriate for a scientific society to take charge of such an institution, thereby securing the advantages of intelligent oversight and of continuity.

(*To be continued.*)

THE THUNDERSTORM OF AUGUST 2nd.

THE month of July, during which thunderstorms are usually most numerous in the South of England, passed with fewer storms than were to be expected, but the first week of August showed the familiar electrical disturbances of hot summer weather in the form of sudden and severe thunder squalls in different parts of the country.

It would be difficult to define the individuality of a thunderstorm, or to decide whether the consecutive or simultaneous electrical discharges over a large area of country ought to be referred to as one storm, or as different storms, originating separately and pursuing independent paths, and certainly it would be hopeless to attempt any discussion of the kind with respect to a group of storms occurring in the holiday months, when many observers are from home, and correspondence is greatly delayed. We do not, therefore, attempt any full account of the uneasy weather of the first week of August, but confine ourselves to placing on record a few of the numerous communications sent to us on the subject, some of which give a very graphic account of what occurred.

The thunderstorms of August 2nd were experienced in all parts of the country, and as a rule, while the lightning was intensely vivid and the accompanying rain and hail very severe while they lasted, the duration was short, and few cases of serious damage are reported. After the storm passed a lunar rainbow was seen in many widely separated parts of the country, the contrast of the placid moonlight as the storm-cloud retreated, with the fierceness of the outburst of the short thunder-squall being frequently referred to.

In London the rainfall was comparatively slight, only ·12 in. falling at Camden Square, where the shower lasted for 12 minutes. In other parts of London, however, much heavier falls took place ·79 in. being recorded at Greenwich. The *Daily Telegraph*, in a lively account of the storm, records a humorous incident which we quote:—

"While Lord Hylton was speaking in the House of Lords last night, the thunderstorm burst with a suddenness that caused considerable surprise. The surprise, however, was turned to consternation when, through the open windows, the rain beat in heavily, pattering down upon the heads of the noble lords, many of whom left the Chamber hurriedly to get their hats. Others sought temporary refuge under the galleries. The Lord Chancellor did not weather the storm long, for he at once vacated the Woolsack, leaving Lord Halsbury to preside. The late Lord Chancellor lacking the protection of either wig or hat, anxiously rubbed his head with his hand, as if he seriously felt the inconvenience of the position, for he was unable to seek shelter, and for the occupant of the Woolsack to wear a hat would be a serious breach of the rules of the House. One of the bishops sheltered himself by holding a copy of the Education Bill over his head. Two Liberal lords were heard afterwards to

comment on the fact, one of them remarking that it could not now be denied that the bill had proved a protection to the Church. It was some minutes before the windows were closed. During the incident little attention was paid to the debate, members gathering and chatting together."

The storm appears to have been most severe at Guildford, where the strength of the squall seems to have reached a maximum and wrought great destruction. The remarkable site of the town, in a narrow gap of the North Downs, no doubt intensified the force of the wind. Excellent accounts appeared in the *Surrey Times* and *Surrey Advertiser*. Mr. J. H. Billing, at Maori Road, Guildford, recorded 1·01 in. of rain (including hail) in about 17 minutes. The wind destroyed immense numbers of fine old trees, and most of the damage to houses and structures was due to the fall of trees. Two fatal accidents occurred in this way, and the number of narrow escapes was remarkable.

The storm which visited the Guildford and Godalming district on the 2nd was so peculiar, that I am sending you cuttings about it from the *Surrey Advertiser*. Here, at Chiddingfold, we appeared to be just on the South-eastern edge of the storm, and felt very little of it, although it was very fierce at Witley, two miles north of us. The clouds in the forenoon were very striking, cirrus of various types: windy, thready, tailed and feathery; and in the feathery there was a remarkably conspicuous ring of cloud, which I suspect was really a spiral. The clouds were at different altitudes, and I should think rather high. About 8.15 p.m. a heavy cloud-bank passed over us, in which red lightning was incessant, darting from cloud patch to cloud patch, but apparently none to earth; and there was no blue lightning, the usual colour of cloud to earth discharges through dry air. The bank came up rather quickly from the south-west, and the greater mass of it passed north-west of us. As far as I could connect flash and report, the distance of the most intense flash, about 8.30 p.m., was 3 miles. As the rear of the bank lifted, about 8.25, the light underneath it showed heavy rain falling to the W.S.W., and we experienced sudden violent puffs of wind; the sound of rain reached us, and we were ready to bolt indoors should it come on, although at the time the rain which we could see was a long way off and not coming towards us, when a heavy spat of rain fell on us quite suddenly, as if a bucket of water had been thrown over us from the passing bank. It did not last long, and the total fall was ·03 in. At 8.45 the storm was passing away, N.E. and S.E., with lightning still playing from cloud to cloud, whilst im the rear it was clearing up fine with little wind but cool air. Mr. Welch's barograph at Cranleigh shows a jump at 8.20 of about a tenth of an inch.

Colonel Godwin-Austen's position at Nore, on the east side of Hascombe Hill, was much more favourable for observing than ours,

as we are surrounded by tall trees. What he says about there being two storms is remarkable; I should be inclined to think that there was one, split into two branches by the Hindhead hills, as I have often seen rain pass S.W. and N.W. of those hills, whilst none fell directly under the lee of them. Doubtless you know that a good illustration of the brush discharge among clouds can be given by tearing wetted cotton wool into separate lumps, and connecting two sides with the terminals of an electric battery; the discharges dart from lump to lump.

J. P. MACLEAR.

Chiddingfold, Godalming, 11th August, 1906.

Colonel Godwin-Austen says in the *Surrey Advertiser*:—

"I was induced to make these notes owing to the appearance of the clouds on the westward, the rapidity with which the storm came up, and the rapid changes that took place. The position of Nore is very suitable for such observation, being 400 feet above the sea, and overlooking a great extent of the weald of Sussex.

7—7.30 p.m.—Distant thunder first heard on the west, where a very dense mass of irregular shaped cloud, dark purple in colour, was visible against a clear sky.

8.15.—Two storm centres were apparent. One was far distant in the Horsham direction, and some distance beyond that, probably over the Channel, indicated by a lofty pyramidal mass of cloud, lighted up from time to time by lightning flashes. (This was the storm severely felt at Seaford). The other was close on the west and moving on to the north-west, the southern edge of the clouds being directly above Nore; clear sky south of that, and moon bright.

8.20.—A few large drops of rain fell but soon ceased.

8.25.—Clouds spreading more to the southward, a few scattered drifting across the moon from the south-west. Constant rumble of thunder and much nearer and incessant lightning on the west and north, often at a great height in the clouds, horizontal and ribbon like, and on four occasions from west to east, terminating suddenly and explosively into a cascade of large and small sparks, falling towards the east with the wind.

8.30.—The clouds had reached the southern side of the heavens, and stretched away in a great dark arm to the Downs near Petworth, near where rain could be seen descending in an isolated area. (I have since ascertained this was at Ball's Cross). But there was no lightning on that side. Flashes of lightning appeared very high on the north.

8.40.—The western horizon now clear. Wind rising, gusty, but not strong; storm passing away on the northward, from west to east, parallel to our position, this evidently being on the south edge of the disturbance. Rain beginning and a few scattered hailstones.

8.45.—Very dark and light, sharp-edged clouds to the south, the moon's light behind them adding to the striking effect.

8.50.—All overcast on southward, clear sky to the north-west. Distant thunder now going on to the north-north-east. The rain ceased at this

time: it just wetted the grass slightly. Second storm, lightning far to south-south-east, constant and high up in the clouds.

9.0.—The southern, sharp, defined edge of lofty cloud, passing north-eastward, over the zenith above Nore. The lightning and distant thunder now heard to the eastward.

9.5.—Vivid lightning to the south-east over the weald, with a very distant rumble of thunder not heard by myself. It appeared as if the two storms were meeting some 25 miles to the eastward.

9.10.—Most vivid lightning to the south-east; flashes constant on the east.

9.20.—Bright moonlight and clear sky to the south and west; lightning far away to the eastward.

9.40.—The storm had passed away far beyond Leith Hill, and northward of that elevation. Its position was now indicated by a lofty mass of cloud, and of no great breadth from south to north. It was apparent the area it covered at any one time was very limited, perhaps somewhat longer from west to east than from south to north. After 9.40, with the exception of a few thin scattered clouds coming up from the south-westward the sky was now cloudless.

The storm had a very defined southern edge, leaving the western weald, down to the coast, cloudless and rainless, except for the very partial cloud and rain that passed over Petworth, with a gusty wind.

From the accounts received since, the storm area had an extreme breadth of perhaps 12 miles, for from Nore to Loseley, where the force of the wind was at its maximum, is about six miles. The rain, with hail, only lasted ten minutes, and the storm from commencement to close on westward, reaching its maximum and departure, seemed to be covered in from 25 to 30 minutes.

H. H. GODWIN-AUSTEN."

A thunderstorm occurred in Surrey on the 2nd August which was remarkable at Haslemere for the rate of rainfall. From 6.30 p.m. beautiful cumulus clouds were passing over from the S.W.; in the N. a most curious fine net-like cloud of graceful form remained some time. At 8 p.m. lightning began in the S.W. and continued constantly, without noticeable intermission, for about an hour. Low growling thunder began about 8.15 and increased in volume, but was never very loud. At 8.30 rain suddenly began in torrents, flooding the lawn in a moment; at 8.38 it ceased quite suddenly—amount measured, ·66 in., duration of fall, 8 minutes. This gives a rate of about 4·90 in. per hour. The thunder ceased after the rain, but the lightning continued, now in the N.E., where it came downwards to the earth in lines, occasionally in ordinary flashes. The storm travelled from S.W. to N.E. by way of S. and E. Wind remained S.W. and was of gale force for a few minutes about 8.25. Hail is reported one mile to the S.E., but none fell at Hazelhurst.

T. P. NEWMAN.

Hazelhurst, Haslemere, Surrey, August 3rd, 1906.

The following instrumental observations were made during the storm at Epsom :—

Barometer (uncorrected).			Dry Bulb.	Wet Bulb.
9 a.m.	...	29·880	9 a.m. ... 74·8 ...	66.3
8 p.m.	...	29·688	7 p.m. ... 77·0 ...	66·0
8.15 ,,	...	29·670	8 ,, ... 75·0 ...	65·0
8.45 ,,	...	29·660	9.20 ,, ... 68·0 ...	66·0
8.50 ,,	...	29 638	10.30 ,, ... 65·0 ...	64·0
9 ,,	...	29·650		
9. 7 ,,	...	29·614	Maximum Temperature, 85·2	
10·30 ,,	...	29·612	Rain and hail, 9 p.m. to 9.10 p.m.	
			Amount = ·11 in.	

The following are notes of visual observations :—

At 8 p.m. thin veil of cirro-stratus over sky, thunder clonds visible (1) in E. and S.E. (distant thunder had been heard previously in S.E. at 7.15) and (2) in S.W. and W. Wind S.E. to S., force 4, hot gusty puffs. 8.15 p m., sheet lightning first seen in S.W. 8.20 p.m., sheet lightning continuous in S.W., W., and N.W. 8.25 p.m., fork lightning first seen due W. 8.30 p.m., distant rolling thunder first heard in S.W.; not possible to obtain a time interval owing to lightning being continuous. 8.45 p.m., thunder approaching nearer, continuous sheets of flame in S.W. to W., sheet and fork lightning blinding in its intensity. From 8.30 p.m. to 9 p.m. vivid continuous sheet and fork lightning, accompanied by distant and almost continuous rolling thunder. At 9 p.m. heavy drops of rain commenced, followed at 9.1 p.m. by a hail squall lasting four minutes, and heavy rain to 9.10 p.m.

Wind S.E. to S., force 4, to 9 p.m. (commencement of rain) when a strong squall broke lasting about five minutes, wind going round through S.W. and W. to N.W. and dropping calm.

9.10 p.m., loud thunder crash almost overhead, sheet and fork lightning continuous and very vivid. 9.15 p.m., storm passing away in a N.E. to E. direction, lightning playing all round the sky; sky clearing in W. and S.W., covered with broken pearly white cumulus, stars visible. 9.27 p.m., interval between lightning and thunder, 15 seconds. 9.50 p.m., thunder last heard in N.E. Sheet lightning (reddish to a bluish white) remaining visible in N.E. to E., practically continuous to 11 p.m.

SPENCER C. RUSSELL.

Epsom, Surrey, August 2nd, 1906.

At 8.57 p.m. on 2nd inst., a short but very heavy thunderstorm broke over this neighbourhood, accompanied by large hailstones (some of which were 3 inches in circumference) and wind at the force of a gale. At 9.10 p.m. the storm passed away to E.N.E. During the 13 minutes, ·33 in. of rain was recorded in a 5 in. gauge with deep funnel.

Considerable damage was done by hailstones and wind to glass, trees, flowers and fruit—apples being cut and bruised. The funnel of a copper Glaisher gauge was dented in several places, and a solar radiation thermometer smashed by the force of the hailstones.

Sheet and forked lightning was almost continuous, being visible from 8.15 to midnight.

W. J. CARTER.

Edenfield, New Malden, Surrey, 3rd August, 1906.

On the evening of the 2nd inst. a thunderstorm was observed approaching from the S.W., the lightning being very vivid.

At 8.45 p.m. the first rain fell, the barometer standing at 29·64 in., the thermometer 71°·5. At 9 p.m. the barometer had *risen* to 29·72, at 9.9 p.m., when the rain ceased, it had *fallen* to 29·66, the thermometer to 66°. The storm lasted only 24 minutes, during which time ·40 in. of rain fell, mixed with some hail, the stones measuring over $\frac{1}{4}$ inch in diameter.

I have never before observed such great fluctuations in the barometer in so short a time.

H. K. G. ROGERS.

Glenart, Weybridge, 3rd August, 1906.

[These fluctuations, a sudden rise followed by a more gradual fall, are familiar in most severe squalls and thunderstorms. The barograph at Camden Square showed this feature in a typical manner on August 2nd.—ED. *S.M.M.*].

On Thursday, August 2nd, there was a thunderstorm here at 8 p.m. with ·72 in. of rain. Except for a few drops which fell two hours before, the whole of this amount fell in 20 minutes.

CHARLES J. P. CAVE.

Ditcham Park, Petersfield, August 4th, 1906.

A heavy rain in a short period took place here on the evening of August 2nd. ·44 in. fell in 9 minutes, and the greater part of it probably came down in about 6. There was a little thunder and a strong wind.

W. M. CHRISTY.

Watergate, Emsworth, August 4th, 1906.

Miss Mary A. Ewart favours us with the following graphic extracts from a letter written to her on August 3rd from Northbrook, Godalming :—

"We are terribly affected by the awful three minutes' tornado last night. It was quite terrific, coming over from Hindhead and carrying all before it. The lightning came hot and forked, and ran along the paths, and no rain with

it at first; suddenly the hail came—enormous square pieces—then the wind and rain. We rushed to shut the front door, and it took all the strength of three of us to do it, but not before all the hall was strewn with hail. In my bedroom, the bed (16 feet from the window) was covered with hail and the floor white, as both windows were open when the hurricane struck us. Everything was soaked, and the carpet later on was like a pond. The wind made so much noise that we never knew until the hurricane passed over that all the trees, except three, were blown down or stripped of boughs and leaves. All the fine old elms that looked like an avenue down the field are gone, and the dear old oak has its boughs torn off, and snapped on the right side where the gale struck it. Hardly a tree on this high open ground has escaped, and the wrecked look is something too sad for words. The flower borders, which were really perfectly beautiful, are burnt and torn, and desolation under a burning sun is what we look at this morning. Trees are down across the road, and we hardly know where to begin clearing up. The oat crop, which was cut yesterday, is carried away by the wind, the straw shaken and not a grain left, no threshing machine ever equalled the work done by this three minutes of hurricane. It all seems like a bad dream, except that the poor torn stripped trees stare us in the face."

Correspondence.

To the Editor of Symons's Meteorological Magazine.

VIOLENT RAINSTORM AT WEYBRIDGE ON JULY 12th, 1906.

AROUND the hour of 4 p.m. on July 12th, at Weybridge, a heavy thunder-shower characteristic of the season occurred. After the storm the river Thames was much swollen, and I saw the carcass of a pig afloat at Shepperton. I could not ascertain the amount of rain that fell in the district on the afternoon in question, but you will probably be able to state the figures.* The storm appeared to be heavy towards Surbiton.

The interesting feature of this storm, to my mind, was the light it threw upon the probable immediate cause of these midsummer cloudbursts. An ascending current of air is generally regarded as the chief cause of the precipitation of rain; it should rather, perhaps, be considered as an essential accompanying condition of such precipitation, which, however, may be called an immediate cause. In the large cyclonic storms of the winter months, the comparatively light intermittent rains that are brought by south-westerly winds in those portions of the atmospheric depressions lying to the right of the paths of the centres may be regarded as the product of the strong

* On July 12th the rainfall at Surbiton was ·24 in.—ED. *S.M.M.*

upward movement of the south-westerly winds, but the persistent and heavy "forty-eight hour" rains brought by north-easterly winds in those portions of the depressions lying to the left of the paths of the centres probably involve other additional causes.

Now it seems immensely improbable that heavy thunder rains of the type that occurred at Weybridge on the 12th inst. can be originated by a simple upward current of air even in very warm moist weather without a very much more marked local wind disturbance at the surface than is usually experienced on these occasions. On July 12th the temperature was distinctly low for the season, and the weather though fairly fine was cloudy and gusty all day, having shown a tendency to be showery from the early morning, so that it is even more unlikely that this particular storm owed its sole origin to a local upward convection current. Doubtless, the black cumuloform clouds which rendered the storm possible, were the product of the ascent of moisture-laden air, and this assumption is borne out by the fact that the storm occurred soon after the warmest part of the day, but the actual deluge was probably occasioned by the impact against the clouds of a cold current of air associated with the peculiar distribution of atmospheric pressure. (Refer to Weather Chart of July 12th for distribution of pressure over England.) At the surface at Weybridge *cold gusts of wind* were persistent all day. The final court of appeal in these cases is, of course, direct observation and experiment; but direct observation and experiment, could kites put the matter to the test, would probably show that upward convection currents *alone* are inadequate to precipitate the destructive rains of the type under discussion.

L. C. W. BONACINA.

Ide Hill, nr. Sevenoaks, Kent, July 25th, 1906.

Very different from the storm referred to above were the thunderstorms of the 2nd of August. Towards evening of that date, after a most oppressively hot day, thunderstorms of great intensity were developing "anywhere and everywhere" over the land, and the violent destructive local winds associated with the storms would seem to indicate powerful ascending currents of hot air as the prime cause of the disturbances.

Only on one other occasion, namely during the night of June 11th, 1900, at Clitheroe, Lancashire, have I seen a display of lightning of the same order of magnificence as that at Ide Hill on August 2nd.

At 7 p.m. red discharges were rending the clouds in all directions, and apparently running along their under surfaces from one end to the other; between 8 and 9 p.m. forked lightning of a very severe type prevailed, and there was practically no interval between the flashes.

L. C. W. B.

Ide Hill, Sevenoaks, August 4th, 1906.

THE METEOROLOGICAL OFFICE EXHIBIT.

On July 6th, Dr. W. N. Shaw held a reception in the Meteorological Office, to show the Exhibit which had been prepared in illustration of Methods and Results of Meteorology, for the International Exhibition at Christchurch, New Zealand, to be held in the coming (antipodal) summer. It was largely attended, and the excellent arrangement of the exhibits representative of the meteorological activity of the British Isles was fully appreciated. The view taken by the Meteorological Office in preparing this exhibit was a wide one, and included the various bodies concerned in the study of meteorology, which are unaided by public funds, and untrammelled by government control, justice being thus done to the great army of volunteer Observers and to the Societies which help to maintain the independent status of meteorological science.

The exhibits were grouped in three divisions, which may be briefly summarized:

I.—*The collection and discussion of observations from the ships of H.M. Navy and the Mercantile Marine.* This consisted of sets of instruments exhibited by Messrs. Negretti and Zambra, and Mr. J. J. Hicks, photographs of the placing of the instruments on board ship, specimens of ship's logs, and a set of the publications in which the marine observations are set forth, after being worked up in the Meteorological Office, including the Monthly Meteorological Charts of the North Atlantic and Indian Oceans, various synoptic weather charts, and various charts of winds, currents, and sea-temperatures.

II.—*Telegraphic Reporting. Forecasts and Storm Warnings.* Here were shown a map of the world showing the portions of the globe for which daily weather reports are issued; a set of instruments, lent by Mr. J. J. Hicks, as used at a telegraphic reporting station; photographs of meteorological stations and a complete set of the books used in recording and dealing with the telegraphic reports and compiling the Daily Weather Reports. Included with those representing the work of the British Meteorological Office there was an exhibit contributed by Mr. R. F. Stupart, Director of the Canadian Meteorological Office, illustrating the work done in that colony.

III.—*British Meteorological Organizations. Voluntary Stations.* Here Messrs. Negretti and Zambra showed the full equipment of a normal climatological station. The Meteorological Office showed a complete set of the forms used in collecting the data and preparing the Weekly Weather Report, the Monthly Report and the meteorological pages of the Registrar-General's Quarterly Return. The Royal Meteorological Society sent a map showing the Society's stations and specimens of its publications, including the *Quarterly Journal* and *Meteorological Record*. The Scottish Meteorological Society was similarly represented, and so was the British Rainfall

Organization, the map in this case serving to show, not the individual rain gauges, but the comparative density of their distribution over the country. This map is reproduced on a small scale in *British Rainfall*, 1905.

A series of remarkably interesting diagrams illustrating the application of statistics was included in this section, the most attractive being the relations between weather and crops in England. Sir Norman Lockyer showed diagrams illustrating the probable relations between the meteorological conditions in widely distant parts of the Earth, and Mr. F. J. Brodie had a map of the mean annual prevalence of thunderstorms over the British Isles.

IV.—*Observatories (Stations of the First Order) and automatic recording instruments.* Photographs of the standard photographic recording instruments, and examples of various mechanical recording rain-gauges, anemometers and thermographs were shown, together with a very interesting set of records from the various instruments.

In this section also there were models of Mr. Dines's kites, specimens of his meteorographs, and microbarograph, as well as instruments for the observation of clouds.

Considering the value of such an exhibit to the ordinary observer, who has few opportunities of seeing the records of the more costly instruments, and to the general public, we wish that it could be found possible to arrange for permanent collections of the same nature in London and other large towns. The exhibit lent by the Royal Meteorological Society to local scientific societies is a move in the right direction, though it lacks the advantage of permanency.

SCOTTISH METEOROLOGICAL SOCIETY.

THE half-yearly meeting of this Society was held in Edinburgh, on the afternoon of July 12th, the Hon. Lord Maclaren in the chair.

Mr. Arthur Watt read a paper on the rainfall of May, 1906, in Scotland, illustrated by maps, showing the average rainfall for May, the distribution of rainfall in May, 1906, when unprecedented falls occurred in many districts, and the distribution of rainfall on two particular days, when heavy falls occurred in different parts of the country. Dr. Knott, Mr. R. T. Omond, Dr. Buchan, and others, took part in the discussion.

Mr. Watt also read a paper on the climate of Hebron, Syria, discussing the ten years' observations made by Dr. Alexander Paterson at that place, and Dr. Paterson contributed an interesting paper of a more general kind on Hebron and its climate, which he said was much the same as the scriptures showed it to have been 3000 years ago.

TEMPERATURE FOR JULY, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [° E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32° Shade.	Grass.
Camden Square	*London*	51 32	0 8	111	83·7	18	45·2	1	0	0
Tenterden	*Kent*	51 4	*0 41	190	85·5	30	43·0	2	0	0
West Dean	*Hampshire*	51 3	1 38	137	80·0	30	37·0	1	0	4
Hartley Wintney	,,	51 18	0 53	222	80·0	18, 23	40·0	13	0	...
Hitchin	*Hertfordshire*	51 57	0 17	238	80·0	23, 30	43·0	4	0	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	82·0	30	43·0	1, 21	0	...
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	85·5	30	43·0	12	0	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	75·2	4	36·4	1	0	1
Torquay (Cary Green)	*Devon*	50 28	3 32	12	75·6	22	44·5	1	0	0
Polapit Tamar [Launceston]	,,	50 40	4 22	315	74·9	22	39·4	10	0	0
Bath	*Somerset*	51 23	2 21	67	80·0	30	43·0	12	0	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	80·0	30	50·0	10§	0	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	78·0	30	39·0	1	0	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	78·0	30	37·0	13	0	...
Boston	*Lincolnshire*	52 58	0 1	25	80·0	28	45·0	21	0	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	80·4	30	38·7	12	0	4
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	80·0	23, 30	44·0	1	0	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	71·9	5	45·6	13	0	0
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	81·0	28	42·0	5, 12	0	0
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	..	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	73·8	4	42·9	12	0	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	..	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	73·6	26	43·3	12	0	0
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	81·0	31	35·0	11	0	...
Llandudno	*Carnarvon*	53 20	3 50	72	79·0	26	49·0	3	0	0
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	75·0	5	40·0	11	0	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	71·0	4†	40·0	8	0	0
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	69·4	26	43·7	20	0	0
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	73·0	5‡	38·0	11	0	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	72·0	5	43·0	11	0	3
Tighnabruaich	*Argyll*	55 55	5 14	50	64·0	5, 31	39·0	20	0	...
Mull (Quinish)	,,	56 36	6 13	35	72·0	5	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	79·2	22	43·3	20	0	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	..	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	75·0	22	42·0	8	0	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	68·0	13	35·0	1	0	...
Castletown	*Caithness*	58 35	3 23	100	70·0	29	43·0	2	0	0
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	74·0	23	48·0	29	0	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	74·0	22	42·0	4	0	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	73·0	21	46·0	10	0	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	76·5	22	47·4	4	0	0
Ballinasloe	*Galway*	53 20	8 15	160	72·5	21	42·0	3, 4, 12	0	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	..	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	81·0	22	43·0	11	0	0
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	75·0	31	37·0	11	0	...
Hitchen (June)	*Hertfordshire*	51 57	0 17	238	76·0	23	35·0	4	0	...

† and 21, 29. ‡ and 26, 30 § and 12, 20 ‖ and 18, 28.

RAINFALL FOR JULY, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.	Mean Annual 1870-1899.	STATION.
in.	in.	in.		in.	Date.		in.	in.	in.		in.	
2·49	·61	—1·88	24	·21	26	7	13·12	12·09	—1·03	92	25·16	Camden Square
2·26	·43	—1·83	19	·15	11	9	13·81	12·72	—1·09	92	28·36	Tenterden
2·62	·44	—2·18	17	·24	18	9	15·23	16·67	+1·44	109	29·93	West Dean
2·38	·56	—1·82	24	·15	18	7	13·97	13·25	— ·72	95	27·10	HartleyWintney
2·55	·55	—2·00	22	·48	27	6	12·81	13·01	+ ·20	102	24·66	Hitchin
2·77	·48	—2·29	17	·17	28	6	14·05	13·48	— ·57	96	26·75	Addington
2·91	·45	—2·46	15	·10	18	10	13·23	14·30	+1·07	108	25·39	Westley
2·70	·53	—2·17	20	·10	23	11	12·82	16·31	+3·49	127	25·40	Brundall
2·78	1·37	—1·41	49	·59	28	9	19·14	22·55	+3·41	118	39·00	Winterbourne Steepleton
2·73	·78	—1·95	29	·29	28	8	17·78	16·14	—1·64	91	35·00	Torquay
2·93	1·54	—1·39	53	·53	26	17	18·38	21·61	+3·23	118	38·85	Polapit Tamar
2·83	1·03	—1·80	36	·49	28	8	15·86	14·76	—1·10	93	30·75	Bath
2·90	1·16	—1·74	40	·38	28	9	15·73	14·64	—1·09	93	29·85	Stroud
2·66	·61	—2·05	23	·11	13†	11	16·97	14·31	—2·66	84	33·04	Woolstaston
2·38	·80	—1·58	34	·29	14	8	12·95	12·91	— ·04	100	24·50	Bromsgrove
2·44	·36	—2·08	15	·16	10	7	12·20	11·17	—1·03	92	23·30	Boston
2·51	·44	—2·07	17	·21	28	5	13·32	10·74	—2·58	81	24·70	Hodsock Priory
2·63	·55	—2·08	21	·14	11	10	14·11	12·20	—1·91	86	26·18	Derby
4·12	1·90	—2·22	46	·39	16	17	20·87	24·67	+3·80	118	42·43	Bolton
2·61	1·57	—1·04	60	·65	30	11	14·24	13·51	— ·73	95	26·96	Ribston Hall
4·97	2·91	—2·06	59	·56	30	17	31·44	37·06	+5·62	118	60·96	Arncliffe Vic.
2·50	1·75	— ·75	70	·52	11	12	13·74	12·06	—1·68	88	27·02	Hull
2·91	1·46	—1·45	50	·37	31	13	14·26	14·38	+ ·12	101	27·99	Newcastle
9·37	8·42	— ·95	90	1·71	18	17	66·73	71·87	+5·14	108	132·68	Seathwaite
3·52	·97	—2·55	28	·34	13	16	20·71	24·55	+3·84	119	42·81	Cardiff
3·70	1·68	—2·02	45	·32	30	16	23·37	24·51	+1·14	105	47·88	Haverfordwest
4·27	2·51	—1·76	59	·38	13	17	21·86	26·55	+4·69	121	45·41	Gogerddan
2·61	·82	—1·79	31	·21	13	11	14·79	16·54	+1·75	112	30·98	Llandudno
3·30	2·45	— ·85	74	·66	22	11	22·05	22·43	+ ·38	102	43·43	Cargen
3·26	2·38	— ·88	73	·71	22	17	17·14	16·83	— ·31	98	33·04	Riddell House
...	1·79	...	...	·54	2	16	...	14·72	...	...	...	Edinburgh
3·30	2·63	— ·67	80	·80	14	17	22·13	21·38	— ·75	97	44·85	Colmonell
3·36	2·35	—1·01	70	·46	18	21	18·30	20·25	+1·95	111	35·80	Glasgow
4·33	4·30	— ·03	99	·76	14	19	28·98	35·73	+6·75	123	57·90	Tighnabruaich
4·38	4·49	+ ·11	103	1·08	17	22	28·22	27·28	— ·94	97	57·53	Quinish
3·02	·90	—2·12	30	·60	31	8	15·12	11·75	—3·36	78	28·95	Dundee
2·89	1·20	—1·69	41	...	...	...	17·83	18·61	+ ·78	104	36·07	Braemar
3·02	2·54	— ·48	84	1·31	31	14	16·71	16·49	— ·22	99	33·01	Aberdeen
3·34	2·01	—1·33	60	·54	17	15	15·26	16·14	+ ·88	106	29·37	Cawdor
3·78	3·95	+ ·17	104	1·35	17	7	28·50	30·40	+1·90	107	56·00	Invergarry
6·46	9·24	+2·78	143	2·45	18	27	42·50	54·72	+12·22	129	86·50	Bendamph
2·82	3·34	+ ·52	118	1·13	17	11	16·27	21·64	+5·37	133	31·60	Dunrobin Castle
...	2·28	...	...	·43	19	18	...	20·47	..	...	...	Castletown
3·99	3·97	— ·02	99	·79	1	26	29·98	26 76	—3·22	89	58·11	Killarney
3·10	1·81	—1·29	58	·37	31	13	20·29	18·67	—1·62	92	39·30	Waterford
2·94	3·43	+ ·49	117	·60	26	23	17·06	21·39	+4·33	125	33·47	Hurdlestown
3·02	1·59	—1·43	53	·26	12	15	18·05	16·32	—1·73	90	34·44	Carlow
2·63	1·02	—1·61	39	·28	1	13	14·51	13·66	— ·85	94	27·75	Dublin
3·31	3·64	+ ·33	110	·67	31	24	19·23	22·29	+3·06	116	37·04	Ballinasloe
6·15	6·22	+ ·07	101	1·05	27	19	40·44	41·00	+ ·56	101	80·23	Kylemore House
3·59	3·75	+ ·16	104	·69	27	24	25·33	29·44	+4·11	116	50·50	Enniscoe
3·40	2·50	— ·90	74	·50	22	18	20·32	17·93	—2·39	88	38·61	Seaforde
3·47	2·02	—1·45	58	·39	12	22	20·54	23·04	+2·50	112	41·20	Londonderry
3·39	2·75	— ·64	81	·40	12	22	19·25	23·24	+3·99	121	37·85	Omagh
1·89	3·81	+1·92	202	2·69	28	12	10·26	12·46	+2·20	121	24·66	Hitchin

† and 19.

SUPPLEMENTARY RAINFALL, JULY, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	·74	XI.	Rhayader, Tyrmynydd	1·44
,,	Ramsgate, West Cliff Villas	·39	,,	Lake Vyrnwy	1·25
,,	Hailsham	·52	,,	Llangyhanfal, Plâs Draw	·84
,,	Crowborough, Uckfield Lodge	·90	,,	Criccieth, Talarvor	1·10
,,	Osborne, Newbarn Cottage.	·74	,,	Llanberis, Pen-y-pass	4·45
,,	Emsworth, Redlands	·45	,,	Lligwy	1·20
,,	Alton, Ashdell	·46	,,	Douglas, Woodville	2·39
,,	Newbury, Welford Park	·68	XII.	Stoneykirk, Ardwell House	3·11
III.	Harrow Weald, Hill House.	1·17	,,	Dalry, The Old Garroch	3·70
,,	Oxford, Magdalen College..	1·00	,,	Langholm, Drove Road	3·06
,,	Bloxham Grove	·86	,,	Moniaive, Maxwelton House	2·92
,,	Pitsford, Sedgebrook	·77	XIII.	N. Esk Reservoir [Penicuick]	2·90
,,	Huntingdon, Brampton	·63	XIV.	Maybole, Knockdon Farm..	2·47
,,	Wisbech, Bank House	·31	XV.	Campbeltown, Witchburn	2·95
IV.	Southend Water Works	·77	,,	Inveraray, Newtown	4·91
,,	Colchester, Lexden	·25	,,	Ballachulish House	6·70
,,	Newport, The Vicarage	·75	,,	Islay, Eallabus	3·31
,,	Rendlesham	·15	XVI.	Dollar Academy	2·47
,,	Swaffham	·67	,,	Loch Leven Sluice	1·29
,,	Blakeney	·54	,,	Balquhidder, Stronvar	4·50
V.	Bishops Cannings	1·06	,,	Perth, Pitcullen House	1·24
,,	Ashburton, Druid House	·78	,,	Coupar Angus Station	·92
,,	Okehampton, Oaklands	1·27	,,	Blair Atholl	2·65
,,	Hartland Abbey	1·55	,,	Montrose, Sunnyside Asylum	1·76
,,	Lynmouth, Rock House	·72	XVII.	Alford, Lynturk Manse	1·99
,,	Probus, Lamellyn	1·72	,,	Keith Station	2·70
,,	Wellington, The Avenue	·55	XVIII.	N. Uist, Lochmaddy	3·88
,,	North Cadbury Rectory	1·40	,,	Alvey Manse	1·93
VI.	Clifton, Pembroke Road	1·35	,,	Loch Ness, Drumnadrochit.	2·02
,,	Moreton-in-Marsh, Longboro'	1·12	,,	Glencarron Lodge	8·51
,,	Ross, The Graig	·50	,,	Fearn, Lower Pitkerrie	1·93
,,	Shifnal, Hatton Grange	1·08	XIX.	Inversbin	3·44
,,	Cheadle, The Heath House.	·85	,,	Altnaharra	3·27
,,	Coventry, Kingswood	·97	,,	Bettyhill	3·87
VII.	Market Overton	1·14	,,	Watten Station	2·16
,,	Market Rasen	1·16	XX.	Dunmanway, The Rectory..	4·15
,,	Bawtry, Hesley Hall	·58	,,	Cork	3·27
VIII.	Neston, Hinderton	1·11	,,	Darrynane Abbey	4·30
,,	Southport, Hesketh Park	1·18	,,	Glenam [Clonmel]	2·47
,,	Chatburn, Middlewood	2·08	,,	Ballingarry, Gurteen	3·30
,,	Cartmel, Flookburgh	2·98	,,	Miltown Malbay	3·28
IX.	Langsett Moor, Up. Midhope	3·30	XXI.	Gorey, Courtown House	1·07
,,	Scarborough, Scalby	1·08	,,	Moynalty, Westland	2·76
,,	Ingleby Greenhow	1·66	,,	Athlone, Twyford	3·56
,,	Mickleton	1·51	,,	Mullingar, Belvedere	2·34
X.	Bardon Mill, Beltingham	1·87	XXII.	Woodlawn	3·75
,,	Ewesley, Fallowlees	2·28	,,	Westport, Murrisk Abbey..	2·60
,,	Ilderton, Lilburn Cottage...	1·54	,,	Collooney, Markree Obsy..	2·22
,,	Keswick, York Bank	2·82	XXIII.	Enniskillen, Portora	2·42
XI.	Llanfrechfa Grange	·73	,,	Warrenpoint, Summer Hill.	2·41
,,	Treherbert, Tyn-y-waun	2·38	,,	Banbridge, Milltown	1·91
,,	Carmarthen, The Friary	1·68	,,	Belfast, Springfield	2·25
,,	Castle Malgwyn [Llechryd].	·95	,,	Bushmills, Dundarave	1·75
,,	Plynlimon	4·75	,,	Stewartstown, The Square..	2·96
,,	Tall-y-llyn	2·00?	,,	Killybegs	4·76
,,	New Radnor, Ednol	·87	,,	Horn Head	2·77

METEOROLOGICAL NOTES ON JULY, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Splendid weather prevailed throughout, with high temp., a large amount of sunshine and pronounced absence of R. TS on the morning of 27th. Mean temp. 64°·9, or 1°·6 above the average. Duration of sunshine 235·9* hours and of R 8·6 hours.

CROWBOROUGH.—Brilliant weather with no extreme or oppressive heat. Several moderate TSS. R 1·89 in. below the average of 35 years. Mean temp. 61°·5.

BURY ST. EDMUNDS.—Dry and hot, with the least R, except in 1868, for 50 years.

WINTERBOURNE STEEPLETON.—A cold July, especially at night, grass frost being registered on 1st. R about an inch below the average.

TORQUAY.—Duration of sunshine 272·8* hours, or 49·8 hours above the average. Mean temp. 62°·1, or 0°·3 above the average. Mean amount of ozone 4·4.

NORTH CADBURY RECTORY.—Pleasant and summerlike, with low R but temp. below the average. The air was frequently very humid and a large hay crop was got in with difficulty.

CLIFTON.—Fine on the whole, with moderate temp. and weather mostly of the "westerly type" with slight R every few days, the total being 1·65 in. below the average.

ROSS.—Remarkably dry, with no TSS and average temp. Only 4 previous Julys had lower R since 1818.

BOLTON.—Very bright and dry. Owing to excessive humidity and absence of wind, the heat was on many days oppressive, though the mean temp., 56°·6, was 1°·0 below the average. Duration of sunshine 150·7* hours, or 0·5 hours above the average.

SOUTHPORT.—The tenth consecutive abnormally dry July. Mean temp. 59°·2, or 0°·5 below the average. Duration of sunshine 224·4* hours, or 12·0 hours above the average. R 1·81 in. below the average; duration 25·3 hours.

LILBURN.—Very dry, with warm days and cool nights. Severe TS on 31st, and severe damage by L in many places, but not here.

HAVERFORDWEST.—Fine and warm, with small R. Hay crops were good and well saved and crops generally were looking well. Duration of sunshine 148·0* hours.

DOUGLAS.—Fine on the whole, with much bright sunshine and many beautiful days. The record was, however, sadly marred by wet, windy and even wintry weather from 12th to 20th.

INVERARAY.—Variable, with only two or three days of real summer weather. The earlier part was cold and the latter wet.

ABERDEEN.—TS on 31st with 1·31 in. of R from 11 a.m. to 7 p.m.

WATTEN.—The first part was dry and cloudy. A severe and prolonged storm of wind and R occurred on 19th and 20th.

CASTLETOWN.—About midnight on 18th a strong westerly gale set in, attaining the force of 8—9 during the forenoon of 19th and lasting till noon on 21st. The last few days were dry, warm and foggy, except 31st, which was wet.

DARRYNANE ABBEY.—R 14·8 per cent. above the average, only 3 days being without R. Fog on 21st and 22nd.

MILTOWN MALBAY.—Generally damp, with lowering skies and little sunshine. As usual, this weather left potato blight, which is now general.

DUBLIN.—A favourable month, with westerly winds, often cloudy skies, an frequent but not heavy R. Mean temp. 60°·7.

OMAGH.—As a rule the weather was dark and cloudy, but as the R was below the average for the first fortnight a heavy crop of hay was saved in excellent order in all but backward districts.

* Campbell-Stokes.

Climatological Table for the British Empire, February, 1900.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	51·1	24	26·1	22	45·0	33·3	34·7	87	85·1	20·3	1·89	21	6·1
Malta	67·9	28	40·2	14	57·9	47·3	43·9	76	115·5	34·3	6·45	18	5·3
Lagos	91·0	6, 9	72·0	2	88·1	76·3	73·1	76	140·0	63·5	2·18	8	4·5
Cape Town	101·5	20	54·0	2	79·5	62·1	56·9	62	...	...	·05	2	2·2
Durban, Natal	92·0	13	60·1	18	84·1	67·6	...	...	154·4	...	6·31	15	4·9
Johannesburg (?)	79·8	26	47·6	19	73·3	54·8	56·1	84	155·6	43·2	8·54	13	4·9
Mauritius	90·1	8	71·4	24	87·2	74·0	73·6	81	160·4	65·3	5·04	23	7·2
Calcutta	87·4	9	53·1	1	79·0	62·7	62·5	76	154·0	48·5	7·96	8	5·1
Bombay	90·0	28	62·0	25	81·3	66·9	61·9	68	142·0	53·6	·15	2	1·5
Madras	94·8	19*a*	64·4	3	87·9	72·6	71·0	77	146·3	60·3	·94	3	3·2
Kodaikanal	73·1	23	47·2	3	67·3	50·7	47·3	68	141·8	29·7	3·37	4	4·0
Colombo, Ceylon	90·0	21	70·6	5	88·2	75·7	72·1	76	151·0	68·0	·85	4	2·5
Hongkong	79·1	22	47·0	2	64·0	56·6	57·2	87	131·2	...	2·25	15	9·1
Melbourne	105·1	21	48·3	25	81·4	58·4	55·2	62	159·1	37·2	·44	7	4·7
Adelaide	108·6	7	53·5	10	92·0	66·4	55·3	45	160·4	45·0	·12	3	3·3
Coolgardie	105·0	19	58·1	9	93·6	66·2	61·5	53	175·9	56·9	·89	8	3·2
Sydney	97·3	22	60·2	14	78·2	66·6	61·2	69	134·8	53·2	·38	14	6·0
Wellington	70·0	2	41·8	20	63·3	52·8	51·3	80	130·0	38·0	7·48	16	7·0
Auckland	76·0	2	50·0	21	69·8	56·2	52·3	69	140·0	45·0	2·25	8	5·0
Jamaica, Negril Point	87·9	11	64·9	var.	83·4	68·5	68·7	80	...	...	2·05	5	...
Trinidad	90·0	24	63·0	23*b*	85·5	66·6	69·0	77	169·0	58·0	·50	4	...
Grenada	85·8	26	69·0	16	83·1	71·4	68·2	73	150·8	...	1·92	18	3·0
Toronto	53·0	24	—12·8	2	31·0	13·6	16·2	79	71·0	-16·0	·80	12	5·8
Fredericton	53·3	22	—14·3	17	34·4	7·8	8·3	60	...	...	2·04	7	5·7
Winnipeg	38·4	19	—32·5	13	14·2	—10·5	...	...	...	...	·21	...	3·5
Victoria, B.C.	55·2	17	31·0	12	49·4	38·5	...	...	...	...	1·66	14	6·4
Dawson	15·0	27	—39·0	22	—2·6	—13·9	...	...	...	...	·51	6	5·0

a and 23. *b* and 24, 25, 26.

MALTA.—Mean temp. of air 52°·2, or 1°·8 below average. Mean hourly velocity of wind 13·6 miles. Mean temp. of sea 56°·7.

Johannesburg.—2·42 in. of R fell in 43 minutes, tearing holes 6 feet deep in roads.

Mauritius.—Mean temp. of air 1°·4, of dew point 2°·7 above and R 2·20 in. below, averages. Mean hourly velocity of wind 6·8 miles, or 4·2 below average.

MADRAS.—Bright sunshine 226 hours.

KODAIKANAL.—Bright sunshine 202 hours.

COLOMBO.—Mean temp. of air 82°·0, or 1°·8 above, of dew point 1°·6 above, and R 1·22 in. below, averages. Mean hourly velocity of wind 6·7 miles.

HONGKONG.—Mean temp. of air 60°·4, or 2°·6 above, bright sunshine 41·3 hours, or 45·4 below average. Mean hourly velocity of wind 17·0 miles.

Adelaide.—Mean temp. of air 5°·3 above, and R ·49 in. below, averages.

Coolgardie.—Mean temp. of air 4°·9 above average.

Sydney.—R 4·34 in. below, and mean temp. of air 1°·3 above, averages.

Wellington.—Mean temp. of air 4°·4 below, and R 4·24 in. above, averages.

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LOCAL SOCIETIES AND METEOROLOGY.

(*Continued from p.* 125.)

The value of a record of climate grows with its length, and the interruption of private records by death or removal is a difficulty most grievous to the investigator who desires to study the climate of any locality.

A complete meteorological observatory, with self-recording apparatus of the highest accuracy, forming what is technically termed "a first order station," is a costly matter, and involves a paid staff; but a second order station, at which the instruments are read by the eye only, twice a day, is well within the powers of even a small Society. Full particulars of the equipment of such a station may be found in the admirable practical handbook "Hints to Meteorological Observers," by Mr. W. Marriott, of the Royal Meteorological Society, and any request for advice in the establishment of a station addressed to the Secretaries of that Society, at 70, Victoria Street, London, S.W., will receive a sympathetic reply. In Scotland similar enquiries might be addressed to the Scottish Meteorological Society, 122, George Street, Edinburgh.

The Royal Meteorological Society is doing a great deal to disseminate correct views of weather-study, and has arranged a scheme of lectures and exhibitions of apparatus and maps in connection with local societies that ought to be taken advantage of largely. It would be well for any Society taking up such work to arrange for two or three observers who could be trusted to relieve each other, so that the work could be carried on continuously, without imposing too heavy a burden on any one person; but it would be well also for one individual to be responsible for the record, both for preserving the original in safety and for making an authentic copy for transmission to some central authority.

There is an amount of uncertainty as to the mean temperature and the other conditions of climate, even in the thickly-peopled parts of England, which is hard to believe until one tries to ascertain definite figures on the subject. It is not creditable that such a state of matters exists, and it is very easy to obviate it at small expense, though for many years the chief value of the work must

lie in the future. Meteorological data differ greatly in their nature, and some require more observers than others. To two of these I wish to direct special attention, one is the least known, the other the best known, of the elements of climate.

The first is the duration of sunshine. No full or trustworthy map of the average annual duration of sunshine exists, although from the points of view of agriculture and of health, sunshine is of very great importance. Unfortunately there are photographic sunshine recorders on the market which give results that cannot be properly compared, and their use has led to considerable confusion. The instrument which is accepted as a standard by the Meteorological Office and by the Royal Meteorological Society, is the Campbell-Stokes sunshine recorder, which consists in principle of a clear glass sphere focussing the sun's image on a prepared card, in which it burns a hole when the sun is shining. By this instrument only bright sunshine is measured, but the records of different instruments of this type are strictly comparable, and it is most important that the number in use should be greatly increased. I would urge any Society desirous of undertaking an interesting and useful set of observations, but unwilling to establish a complete meteorological station, to set up a sunshine recorder, and after measuring the cards send them to the Meteorological Office, or to one of the Meteorological Societies, for preservation and discussion.

The second matter is on a different footing. It is the measurement of rainfall. A few hundred stations would suffice to give a perfectly fair view of the distribution of pressure or temperature over the whole of the British Isles, because these phenomena affect the air nearly uniformly over wide areas, and are almost independent of local accidents of configuration of the ground. The changes due to altitude above sea-level are simple and can be calculated for any place when the altitude is known. With rainfall it is entirely different. While widespread rains sometimes occur uniformly affecting large areas, there are often sudden heavy showers so local that places a mile apart may have in an afternoon rain differing in amount by an inch or more. It is also known that every variation of form in the land exercises its individual influence on the rain-bearing winds so that every locality has its own characteristic average rainfall with a large range from year to year and a varying chance of sudden heavy falls. For this reason it is necessary in order to represent the conditions of rainfall in the country to have a very large number of stations, and there are, in fact, more than 4,000 observers in the British Isles whose results are regularly published and discussed in *British Rainfall*. If these 4,000 gauges were uniformly spaced out like trees in a new plantation, and if they were all secured against the risk of interruption, no more would be required; but as neither of these conditions hold good, there is an urgent need for new observers in many places, and room for them everywhere. In order not to miss the interesting features of the

more widespread heavy falls of rain there should be a station at every 5 miles, and in order to secure continuity in one locality there should at each five-mile centre be two, if not three stations within half-a-mile of each other, so that when one record comes to an end there may be another close by the relation of which to that ceasing has been established. This is a counsel of perfection, and I do not expect to see it realized ; but it is not too much to hope that five-mile circles from every rain gauge in England and Wales shall intersect, and that ten-mile circles in Scotland and Ireland may at least touch. How far that is from being the case at present can be seen from the map exhibited,* which shows some great gaps the existence of which makes the preparation of annual rainfall maps a matter of doubt and difficulty.

I know of no way so open as this for any Society to advance science and interest its members in a piece of valuable scientific work. While I think it is desirable, in order to ensure uniformity of methods and direct communication as to doubtful points in the records, that every rainfall observer in the country should be in personal communication with the British Rainfall Organization, I feel also that an immense amount of encouragement is given and a valuable check afforded by subsidiary local organizations such as are carried on by numerous scientific societies in many parts of the country. The Meteorological Office supports and inspects a small number of selected stations spread over all parts of the British Isles, the Royal Meteorological Society in England and Wales and the Scottish Meteorological Society in the northern kingdom arrange for and inspect a larger number, and I am not sure whether the following list of local societies which do similar work systematically is complete ; I hope it may be extended, but at any rate it is extremely creditable to the societies concerned and deserves to be followed as an example. For the sake of impartial enumeration they are given alphabetically :—

Croydon Natural History and Scientific Society (Mr. F. Campbell Bayard).—102 stations in north-western Kent and eastern Surrey.

Dorset Field Club (Mr. H. Stilwell).—48 stations in Dorset.

Hertfordshire Natural History Society (Mr. J. Hopkinson). —55 stations in Herts.

Northamptonshire Natural History Society (Mr. C. A. Markham).—41 stations in Northamptonshire.

North Devon Athenæum (Mr. Wainwright, Barnstaple).—30 stations in North Devon and Somerset.

In addition to these Societies there are several county or group organizations which I believe are kept up by individuals without the guarantee of continuity that a Society affords ; these are :—

* Published in *British Rainfall*, 1905.

Cambridge and Huntingdon.—59 stations formerly under the care of Mr. Warren, now being continued by the Editor of *British Rainfall.*

Isle of Man.—9 stations in the care of Mr. A. W. Moore.

The English Lake District.—27 stations the data from which are collected by Miss Marshall, in succession to her father, the late Mr. Stephen Marshall.

Norfolk.—35 stations under the care of Mr. A. W. Preston.

Mid-Wessex.—32 stations in portions of Wilts, Dorset and Somerset, in the care of Rev. H. A. Boys.

Stirlingshire.—22 stations in the care of Mr. C. Stirling.

In addition to these there is the Cornwall County Council with 27 stations, and the Great Central Railway and most of the Canal and Water Companies and Water Authorities in the country which maintain rain gauges on their gathering grounds are enlightened enough to make their records available for scientific purposes.

I am happy at all times to supply full instructions for commencing and carrying on records of rainfall and to endeavour to remove any difficulties which may arise in the course of such work.

REPORT OF KITE COMMITTEE OF BRITISH ASSOCIATION.

Investigation of the Upper Atmosphere by means of Kites in co-operation with a Committee of the Royal Meteorological Society.—Fifth Report of the Committee, consisting of Dr. W. N. Shaw (*Chairman*), Mr. W. H. Dines (*Secretary*), Mr. D. Archibald, Mr. C. Vernon Boys, Dr. A. Buchan, Dr. R. T. Glazebrook, Dr. H. R. Mill, Professor A. Schuster, *and* Dr. W. Watson. (*Drawn up by the Secretary.*)

Since the date of sending in the last report an investigation into the conditions prevailing over the North Sea has been carried on by Mr. G. C. Simpson, who kindly undertook the work at the request of the Joint Committee. Mr. Simpson spent three weeks on the North Sea in the mission ship *Alexandra*, which was attached to the Red Cross Trawling Fleet. The results he obtained have been published in the *Quarterly Journal of the R.Met.Soc.*, Vol. XXXII., No. 137.

Observations were also continued at Oxshott, on behalf of the Joint Committee, down to the end of September, 1905, and the results of these observations, together with those previously obtained at Crinan and at Oxshott, have been published in the *Proceedings of the Royal Society*, A, Vol. LXXVII., 1906.

Since October 1, 1905, the work of obtaining systematic observations has been undertaken by the Meteorological Office, whose station is at present situated at Oxshott; but Mr. Simpson is arranging a kite station on the moors near Manchester, at which it is hoped that kite ascents can be made on suitable days, and more particularly on the days appointed by the International Committee.

The Committee ask for re-appointment, and for a grant of £25.

BRITISH RAINFALL, 1905.*

THE new volume of *British Rainfall* records the total annual rainfall at 4096 stations in Great Britain and Ireland, the number of records having increased from last year approximately at the rate of 1½ per cent. in Ireland, 2 per cent. in Wales, 3 per cent. in England, and 4 per cent. in Scotland. In the usual article on the Staff of Observers a map is given showing the density of distribution of rain gauges over the British Isles, on which all parts of the country more than five miles from the nearest existing gauge are shown in white, and a line encircles those parts of this area which are more than ten miles from a gauge. The largest of these totally unrepresented areas lie in the west, south and north of Ireland; in the central Highlands of Scotland south of the Caledonian Canal, and in Rossshire, Sutherland and Caithness: these are the parts of the country where the establishment of new records is most to be desired.

The usual discussion and maps of monthly and annual rainfall appear, and the occurrence of heavy rain on rainfall days is dealt with in the same detail as in recent years. The number of heavy widespread rains was considerably less than usual; but maps are given of five interesting cases, the most remarkable being that which brought the floods of August 25th in Ireland. In all the cases mapped the area in which a great precipitation occurred lay on the left of the path of a cyclonic disturbance.

The distribution of rainfall in time is dealt with as to (1) number of Rain Days and the number of days with various amounts of rain classified in eight groups, (2) Droughts and (3) Rain Spells; 73 carefully selected records, as uniformly distributed over the country as possible and believed to be perfect in all respects, being analyzed for each of the three discussions.

There are records of duration of rainfall at eight stations, being one more than in 1904, and records of evaporation at eleven stations, and regret is expressed that more determinations of these very important conditions are not made, or if made are not communicated to the Editor.

The special articles in this volume deal with "German Rainfall," a 14-page synopsis of Professor Hellmann's great work briefly noticed on pp. 110-111 of our July number; and with a comparison of the evaporation from a water surface at Camden Square with the other meteorological conditions during 1905. For the purpose of the latter article, the amount of evaporation, amount and duration of rainfall, duration of sunshine, wind-movement 1 foot above the water, mean relative humidity, mean daily temperature of air, 9 a.m. tem-

* The full title is: British Rainfall, 1905. On the Distribution of Rain in space and time over the British Isles during the year 1905, as recorded by more than 4000 Observers in Great Britain and Ireland, and discussed with Articles on various branches of Rainfall Work, by Hugh Robert Mill. The forty-fifth annual volume. London: Edward Stanford. 1906. Pp. 360.

perature of soil at 1 foot, and daily maximum black bulb temperature are all calculated for 5-day periods and also shown on a diagram in the form of smoothed curves. The result of the comparison was to show that when the rate of evaporation was below the average for the year it followed the mean temperature; when it was above the average for the year it followed the sunshine and the black bulb temperature, and that the wind appeared to have had but little effect on the evaporation.

In the introductory "Report" attention is called to one or two definitions intended to improve the terms employed in the discussion of rainfall. These are as follows: *Mean* is used to express the sum of any number of figures divided by that number, and this use of the word sets free *Average* to be employed to denote the mean of any quantity for a number of years. The word *General* is used to designate the mean of any quantity at a number of stations at the same time, or, in the case of rainfall, the mean depth of the rain over any defined area. Thus the average general rainfall of the British Isles means the average depth of the general rainfall of the country for a definite number of years. The words *Rain Day* (instead of rainy day) are taken to mean a day on which at least ·01 in. of rain is recorded; a succession of a certain number of days with no recorded rain is a *Drought*, and a succession of a certain number of rain days is a *Rain Spell*. These terms have been used also in this Magazine for some time and no objection has been taken to them. The most recent, *Rain Spell*, has been approved by Dr. J. A. H. Murray, the eminent lexicographer.

All the familiar features of *British Rainfall* remain as before, but the Editor asks for suggestions as to possible improvement and incidentally indicates the cost of one very obvious improvement—the inclusion of monthly as well as annual values for all stations.

THE BEAUFORT SCALE OF WIND-FORCE.*

THERE are two types of instruments employed in the determination of the velocity of motion of the air: (*a*) the Robinson Cup Anemometer; (*b*) the Dines Pressure-tube Anemometer. The traces of the Robinson anemometer by recording the total distance travelled in a given time by the centre of the cups revolving under the influence of the wind, show the average velocity of the wind during the given

* Abstract of Report of the Director of the Meteorological Office upon an enquiry into the relation between the estimates of Wind-Force according to Admiral Beaufort's scale and the Velocities recorded by Anemometers belonging to the Office, with a report upon certain points in connection with the enquiry, by G. C. Simpson, M.Sc.; and notes by Sir G. H. Darwin, K.C.B., F.R.S., W. H. Dines, F.R.S., and Commander Campbell Hepworth, C.B., R.N.R., Marine Superintendent. Published by authority of the Meteorological Council. Size 12 × 10. Pp. 54. Plates.

time, but afford no information as to the variation of wind velocity during the time; whereas those of the Dines anemometer, consisting of series of oscillations, indicate variations of wind velocity lasting for less than a minute. From the traces of the Dines instrument the mean velocity of the wind per hour can be nearly, though not exactly, estimated by eye, but the measurements are sufficiently accurate for practical purposes. Mr. Dines from his own experiments indicates the relationship between P, the pressure of the wind in pounds per square foot, and V, the recorded velocity in miles per hour by the expression:—$P = \cdot 003\ V^2$; moreover, if h represents differences of pressure expressed in inches of water, and V represents velocity in miles per hour (atmospheric pressure at 30 inches of mercury; temperature at 50° F.) he gives:—$h = \cdot 00073\ V^2$ as the relation according to which his pressure-tube anemometer should be calibrated. From a number of observations made at different places, and discussed by different observers, it is shown that the velocity of the centres of the cups of the Kew pattern Robinson Anemometer should be multiplied by 2·2, in order that a close agreement may be obtained with the wind velocity as recorded by the pressure-tube anemometer. This method for obtaining a constant for the Robinson anemometer depends upon Mr. Dines' empirical graduation of his own type of instrument; and Mr. Dines, presuming that the relation:—$h = \cdot 00073\ V^2$ is correct, is of opinion that his pressure-tube instrument is correct to 1 per cent.

Comparisons between wind velocities as recorded by anemometers, and wind-forces as estimated by observers according to Beaufort's scale, were made a few years ago by Mr. R. H. Curtis and Professor Köppen, who availed themselves of a large number of data, consisting of the wind estimates according to Beaufort's scale, and the mean wind velocities as recorded by anemometers for the hour in which each of the estimates was made. Curtis separates the pairs of data so obtained into groups, having a common Beaufort number, and takes the mean of the velocities in each group; whilst Köppen separates the pairs into groups in such a way that each group has the same recorded velocity, and then by taking the mean of the Beaufort numbers contained in each group, obtains a number (which may contain a fraction) for each velocity. The relation between the Beaufort numbers and wind velocities may be expressed by a curve having Beaufort numbers for abscissa, and velocities for ordinates, and the two curves as obtained by Curtis' and Köppen's method do not correspond. On account of this divergency in the two curves, the Meteorological Council appointed Mr. G. C. Simpson to prepare a report on the subject: he was commissioned to visit the stations at Aberdeen, North Shields, Holyhead, Yarmouth, Oxford and Scilly, and was supplied with the following data:—(1) Data from Scilly, Yarmouth and Holyhead discussed by Curtis; (2) additional data of the same kind for years 1900-02, for five of the above-named stations; (3) special data from Holyhead and Scilly, consisting of

pressure-tube records. The substance of his report may be here summarized :—

(1) The relation between Beaufort numbers and wind velocities as used by observers is expressed by Köppen's equivalents.

(2) When dealing with single observations, Köppen's equivalents must be used.

(3) When it is required to reduce a number of estimates at any place to mean velocities, Curtis' equivalents give the best results.

(4) When it is required to express a number of wind velocities recorded at a place by means of Beaufort's scale, Curtis' equivalents also give the best results.

(5) The mean hourly velocity of the wind, as actually used, is as suitable as any other characteristic of wind velocity, such as the mean velocity in gusts and lulls or the extreme velocity in the hour, for comparing records of wind velocity to estimates of wind-force.

(6) The estimates of wind-force according to Beaufort's scale are affected by the direction of the wind differently in different places; it is not desirable that any allowance be made for the influence of wind direction upon the estimates. The causes of the difference between Curtis' and Köppen's equivalents are discussed by Mr. Simpson in his report.

CURTIS'S METHOD.

Equivalent Velocities.	Beaufort Numbers.										
	0	1	2	3	4	5	6	7	8	9	10
Scilly	2	3	6	9	13	20	26	32	39	46	51
Yarmouth	2	3	5	9	12	18	24	30	37	42	..
Holyhead	2	6	11	15	19	21	24	28	34	42	50
North Shields	3	5	8	13	19	24	27	29	43	...	..
Oxford	2	4	7	12	16	19	24	27	29	...	...
Mean	3	5	8	11	15	19	25	29	36	44	51

KÖPPEN'S METHOD.

Scilly	0	2	5	8	13	20	27	35	43	50	57
Yarmouth	0	1	4	8	13	20	27	35	43	50	..
Holyhead	0	5	10	15	18	22	26	31	40	51	...
North Shields	0	2	6	15	23	30	34	38	42	...	...
Oxford	0	2	7	13	19	24	27	30	35	...	..
Mean	0	2	6	11	16	22	28	35	42	50	58

The two causes as given by Köppen for the difference between his equivalents and those of Curtis are found by Simpson to account for

only a small fraction of the whole difference. The chief cause of the difference is due to the fact that, it being impossible for observers to estimate the force of the wind with accuracy, the errors of observation are not symmetrical with regard to the true mean velocity corresponding to each Beaufort number. Owing to the different frequencies of different wind strengths, the observer when estimating winds of low force has greater chances of estimating winds as of, say, force 2, which (if he made no errors) he would estimate as of force 3, than he has of estimating winds as of force 2, which (if he made no errors) he would estimate as force 1; hence the mean equivalent velocity for force 2 as deduced by Curtis' method, in which the mean velocities of groups having a *common Beaufort number* are taken, is *higher* than the correct one.

On the other hand, the observer, when estimating winds of higher forces, has more opportunities of estimating winds, say, as of force 6, which he ought to estimate as of force 5, than he has of estimating winds of force 6 which he ought to estimate as of force 7; hence the mean equivalent velocity for force 6 as obtained by Curtis' method is too low. It is then in the nature of observational errors that the discrepancy between the curves of Köppen and Curtis mainly lies.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

REMARKABLE DROUGHT IN THE SOUTH OF ENGLAND.

THE total rainfall for the three months, June, July and August, has amounted to only 2·97 in. in this district, made up as follows:—

JUNE.	in.	JULY.	in.	AUGUST.	in.
1st ...	·12	12th ...	·01	2nd ...	·04
16th ...	·07	13th ...	·06	13th ...	·14
23rd ...	·38	18th ...	·12	14th ...	·08
27th ...	·06	19th ...	·16	15th ...	·01
28th ...	1·20	20th ...	·01	16th ...	·02
		26th ...	·18	17th ...	·16
		29th ...	·04	24th ...	·11
Totals	1·83		·58		·56
No. of days ...	5		7		7

Thus a period of 92 days included only 19 days on which rainfall was recorded, and it is worthy of note also that had it not been for the heavy isolated fall on June 28th, the totals for the three months would have been ·63 in., ·58 in. and ·56 in. respectively.

Another peculiar feature is that although the general dry character of the weather has been maintained for so long a period, there have been only two absolute droughts (*i.e.*, rainless periods of more than 14 days' duration). The first of these occurred between the 1st and 16th of June, and the second between the 28th June and 12th July.

As I write there seems little prospect of a break in the dry weather. D. W. HORNER.

Worthing, September 1st, 1906.

THE THUNDERSTORM OF AUGUST 2nd.

In the many interesting reports on the thunderstorm of August 2nd the evidence seems general that while there was no stint of lightning, thunder was not remarkably heavy. Such, indeed, was my experience here. I had not seen such a fascinating display of lightning for many years, but there was next to no thunder. Is not this somewhat out of the common way? Some of the electric discharges took place at an altitude of 45° or more. As to rain, my gauge caught ·07 in. only, whereas near Holborn Bars there must have been a veritable deluge. WILLIAM GODDEN.

West Hampstead, August 29th, 1906.

THE GREEN FLASH.

It is now generally accepted that this is produced by atmospheric refraction, and, as this cause is continually operating, it is remarkable that the phenomenon is so seldom seen. I, therefore, hoped that someone better qualified than I would offer some explanation of the point raised by Mr. Whitmell in his letter at p. 21 of this volume. Can the following considerations be held to solve the difficulty? As the fine particles of matter suspended in the air reflect back the shorter light waves, thus preventing them from reaching the eye of an observer, while they allow the longer waves to flow past them, this would tend to prevent the green flash from being seen, and would act the more effectively in proportion to the number of such particles in the air. That this is really so is rendered the more probable by the facts mentioned by Dr. Rambaut at pp. 23 and 45, viz., that the green flash is not usually found to occur when the sun is strikingly red before setting, and that a haze near the horizon reduces the intensity of the blue-green fringe referred to by him, but does not affect the red fringe. But this cannot be the sole cause, seeing that the particles in question reflect back the short waves entirely away from the Earth; and if this occurred to a sufficient extent to obliterate the green flash completely, it could not be seen either by the help of the belfry, as in Mr. Whitmell's experiment, or of a diaphragm, as in Dr. Rambaut's (p. 44); and yet the

latter was able by means of the diaphragm to exhibit not only the red but also the green flashes as often as he pleased; nor could the green flash be seen through a telescope if it were quite invisible to the naked eye for the reason above suggested. Hence, even if the intensity of the green flash be diminished in the way above indicated, we must search for some additional grounds which would account for its invisibility to the naked eye and its visibility when looked at through a telescope. Dr. Rambaut's diagram (p. 41) shows that the red and blue fringes would always be seen when the sun is low if it were not for the glare of the sunlight. This operates in at least two ways. One is that some of the white rays are deflected from their course by reflection from particles in the air, and such of these deflected rays as are thrown into the lines along which the light from the fringes passes to the eye would overpower this light and prevent the fringes from being seen. This action would continue, though to a smaller extent than formerly, down to the time that the tip of the sun was disappearing, and so it also would make the green flash less conspicuous. If now we adopt Helmholtz's theory that irradiation is caused by the non-homogeneity of the lenses of the eye, we can understand that it should operate more powerfully when the setting or rising sun is looked at directly with the naked eye than with the interposition of a belfry or telescope. In the former case rays of light from a considerable area round the setting sun might, after passing into the eye, be deflected so as to impinge on that portion of the retina where the image of the green flash was, whereas this area would be very greatly restricted in the case of the experiments above referred to. A little consideration will show that if irradiation be supposed to be a sympathetic effect, it might be more intense if the rays from the space around the green fringe came from a wider area; so that, on this theory of irradiation also, the non-appearance of the flash to the unassisted eye, though it could be seen through a telescope, might be accounted for.

ALEX. THURBURN.

Keith.

[This letter travels to the verge of the meteorological aspect of the green flash, and indeed goes beyond it; but the question of the infrequency of the phenomenon is an interesting one, on which, perhaps, more can be said.—ED. *S.M.M.*]

LAMBRECHT'S POLYMETER AND HYGROMETER.

IT is a somewhat remarkable circumstance that the hair hygrometer, the remarkable properties of which were pointed out by De Saussure a century and a half ago, should have remained so little known as a scientific instrument. The analogous catgut hygrometer, propelling a man or a woman outside a toy house according as the atmosphere is humid or dry, has always retained its popularity on the continent,

though less frequently seen now than formerly in this country. It is interesting to notice that hair hygrometers have been more generally used for scientific purposes in the form of recording instruments than in a form suited for direct reading by the eye; but we think that the very serviceable direct-reading hair-hygrometer which has been introduced under the name of Lambrecht's Polymeter should do much to make this form of instrument supplement or even supersede the wet and dry bulb hygrometer.

The Polymeter, for which Messrs. Gallenkamp and Co. are the London agents, consists of a thermometer with the value of the saturated vapour pressure at each temperature marked on a duplicate scale, and a hair hygrometer the indicator of which is a needle moving on a circular dial. This dial has two scales, one being the relative humidity expressed directly in percentage of saturation, the other a series of figures giving the difference between the dew-point and the temperature of the air. From these four scales, the readings of two of which are subject to a simple adjustment made by means of the trident-shaped end of the indicating hand, it is possible to measure the temperature, relative humidity, dew-point, absolute humidity and other relations of humidity and temperature—hence the name polymeter. A book of instructions for the adjustment and use of the instrument, the English of which might be improved by revision, gives all the necessary precautions for obtaining useful scientific results. We have tested the instrument and found its indications to correspond closely with the relative humidities calculated by Glaisher's Tables. On one occasion with the thermometer above 90° we found a serious discrepancy, but inspection showed that the muslin on the wet bulb thermometer had dried on account of the evaporation being greater than the water-conducting power of the wick, the hair hygrometer having been correct.

The great advantage of the polymeter seems to us to be the facility with which the relative humidity may be read off directly without reference having to be made to tables. The rules given for forecasting weather may of course have to be modified in different climates, and it would be an interesting occupation for any amateur meteorologist to test them.

A dew-point hygrometer is supplied by the same makers, which is an interesting modification of the ether hygrometer, the film of moisture being deposited on half of a bright metal mirror which forms one side of the ether chamber, the other half of the mirror, which is not cooled, is separated by a narrow slit cut in the metal, so that the division between the dewed and clear surfaces is extremely sharp and the formation of a film of moisture easily observed.

THE RECENT GREAT HEAT.

In England the month of July is the warmest of the year, and very conspicuously marks the height of a relatively short summer, and it is accordingly in that month that the highest average temperature day and night prevails.

Spells of very hot weather—or, as they are popularly termed, "heat-waves"—however, which are the result of peculiar meteorological conditions allowing the sun's rays to penetrate freely through the atmosphere over a wide area and to produce their maximum heating effect upon the land, are by no means confined to the month of July, but occur frequently in an intense form during August, and occasionally as early as June or as late as September. When a period of great heat occurs early in the autumn, as in the present year, it assumes special prominence in the annals of meteorology, not only because the temperature during it is so much in excess of the normal, but also because it occurs at a time when ordinarily the mean daily temperature begins to decline rapidly with the approaching departure of the vertical sun from the northern hemisphere; and it is a safe deduction to draw that however great the heat may be in the equinoctial month of September, it would have been greater still in the previous June or July *had precisely the same atmospheric and surface conditions* then prevailed.

The most noteworthy features of the recent hot weather were the exceptionally high day temperatures and the low relative humidities associated with them. The shade maximum of 94°·0 at Camden Square on September 2nd, as recorded by the Glaisher screen thermometer, is the highest September reading since 1858, when observations were commenced, and on only three other occasions has this temperature been exceeded or equalled, namely, on July 16th, 1900 (95°·2 F.), July 25th, 1900 (94°·0 F.), July 15th, 1881 (94°·6 F.)

The following are some of the temperatures recorded at Camden Square during the very hot weather; the 9 a.m. and maximum readings being compared with the mean of the averages for August and September :—

	9 a.m. Shade Temp.	Diff. of 9 a.m. Temp. from Average.	Max. Shade Temp.	Diff. from Average.	Min. Shade Temp.	Max. Solar Temp. (black bulb (in vacuo).
	°	°	°	°	°	°
Aug. 30, 1906 ...	62·8	+ 2·3	84·8	+14·9	49·5	119·6
,, 31, ,, ...	74·7	+14·2	93·2	+23·3	54·4	130·5
Sept. 1, ,, ..	80·0*	+19·5	92·0	+22·1	58·7	126·0
,, 2, ,, ..	73·5	+13·0	94·0	+24·1	57·6	131·5
,, 3, ,, ...	74·7	+14·2	89·5	+19·6	56·8	129·4

* 3·0 above previous highest September reading.

The only other occasions with maximum shade temperatures exceeding 90° in September were in 1868 with 91°·0 on 7th, and in 1898 with 91·2 on 8th.

During the 48 years 1858-1906, the maximum shade temperature has exceeded 90° on 41 days, of which 23 have been in July, 10 in August, 4 in June and 4 in September; and there have been only two instances of maximum shade temperatures above 90° on three successive days, viz., August 16th–18th, 1893, with maxima 90°·7, 92°·7 and 93°·6 respectively, and August 31st–September 2nd, 1906, with maxima 93°·2, 92°·0, 94°·0 respectively. In July, 1868, however, there were 4 days with maximum shade temperatures over 90°, and in July, 1900, there were 5, the reading of 95°·2 on the 16th of the latter month being the highest temperature ever registered at Camden Square.

The recent heat has been very great in the north-midland counties, and the highest shade temperature that has come before our notice was 96° at Bawtry, in Nottinghamshire, on September 2nd. Even in Scotland temperatures above 80° were common. At the Edinburgh Observatory a maximum of 85° was recorded on August 31st, and it is probable that in the interior of southern Scotland higher temperatures still prevailed, a reading of 88°·6 being actually recorded at the Coats Observatory, Paisley.

The prolonged heat and drought of the past summer culminating at the end of August in the abnormal weather above discussed, has, of course, been very trying to dwellers in town and country alike, and in many rural districts serious apprehensions of water and milk famine have been recently entertained; but with these disadvantages it must nevertheless be admitted that it is in seasons like the one just passed when the sun's rays strike with dazzling brilliancy upon a browned and glowing country-side, that the full glory of summer is best felt.

We print below a few of the numerous letters that have reached us upon the extreme heat.

Max. Shade Temp.,	Aug. 31st	.....	92°·1
,, ,,	Sept. 1st	.....	93°·4
,, ,,	Sept. 2nd	.....	93°·0

93°·4 is the highest recorded here since observations commenced in 1884. In August, 1893, there were three consecutive days with temp. of 90° or upwards—but not so high as these.

G. SEARLE.

30, Edith Road, West Kensington, W., Sept. 2nd, 1906.

The following table shows the exceptionally high temperatures recorded here during the period August 31st to September 3rd, 1906. All the instruments are standard ones with Kew certificates.

	Shade Max.		Shade Min.		Solar Radiation (black bulb in vac.)
August 31st	92°·0	.....	63°·0	.....	141°·8
September 1st	92°·1	.....	62°·2	.....	140°·2
,, 2nd	94°·6	.....	59°·8	.....	148°·0
,, 3rd	89°·4	.....	60°·1	.....	136°·6

SPENCER C. RUSSELL.

Parkside, Ashley Road, Epsom, Surrey, Sept. 4th, 1906.

The maximum shade temperatures during the last four days as recorded with verified thermometers in Stevenson screen are as follows :—

August 31st	94°·6
September 1st	94°·3
,, 2nd	94°·6
,, 3rd	91°·6

WM. B. BUTLER.

Alva, Reservoir Road, Old Southgate, N., 4th Sept., 1906.

The relative humidities recorded during the last few hot days seem low for this country, and the following figures may be of interest :—

		Dry.	Wet.	Dew Point.	Relative Humidity.
Aug. 31st,	9 a.m.	75·5	64·6	56·9	52
	1 p.m.	90·7	69·1	55·6	31
	Max.	91·8			
Sept. 1st,	Min.	50·2			
	9 a.m.	78·1	66·5	58·6	51
	1 p.m.	91·3	67·8	52·9	27
	Max.	93·0			
	3 p.m.	91·7	67·0	52·2	26
Sept. 2nd,	Min.	49·9			
	9 a.m.	75·2	65·5	58·5	56
	1 p.m	91·6	67·3	52·3	26
	Max.	93·0			
	3 p.m.	92·2	67·7	52·5	25
Sept. 3rd,	Min.	52·2			

A temperature of 90° had not previously been recorded here since observations commenced in 1878, but it seems probable that this figure was reached in July and August, 1876.

H. MELLISH.

Hodsock Priory, Worksop, 3rd Sept., 1906.

I beg to send you the readings of our shade maximum temperature, the highest I have ever registered since regular observations were begun in 1871 :—

August 31st	92°·0
September 1st	94·0
,, 2nd	94·0
,, 3rd	89·0

There are a few clouds floating about this afternoon—the first for several days.

JOHN MATHISON.

Addington, 3rd September, 1906.

TEMPERATURE FOR AUGUST, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Date.	Min. °	Date.	No. of Nights at or below 32° Shade.	Grass
Camden Square	*London*	51 32	0 8	111	93·2	31	45·7	29	0	0
Tenterden	*Kent*	51 4	*0 41	190	90·0	31	47·0	20	0	0
West Dean	*Hampshire*	51 3	1 38	137	88·0	30, 31	38·0	29	0	2
Hartley Wintney	,,	51 18	0 53	222	90·5	31	39·0	29	0	..
Hitchin	*Hertfordshire*	51 57	0 17	238	91·0	31	45·0	27	0	..
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	92·0	31	42·0	19	0	..
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	93·0	31	...	...	...	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	80·7	31	40·2	29	0	0
Torquay (Cary Green)	*Devon*	50 28	3 32	12	76·0	31	50·7	18	0	0
Polapit Tamar [Launceston]	,,	50 40	4 22	315	82·0	31	41·0	30	0	0
Bath	*Somerset*	51 23	2 21	67	88·2	31	46·0	29, 30	0	..
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	84·0	31	53·0	29	0	..
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	84·5	31	39·5	19	0	..
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	89·0	31	40·0	29	0	..
Boston	*Lincolnshire*	52 58	0 1	25	90·0	31	46·0	28	0	..
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	91·8	31	40·6	30	0	1
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	90·0	31	47·0	18, 29	0	..
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	76·2	8	45·5	19	0	0
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	91·0	31	44·0	28	0	0
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	82·5	31	47·0	26	0	..
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	79·6	31	42·0	30	0	0
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	86·0	29	45·0	18, 30	0	..
Llandudno	*Carnarvon*	53 20	3 50	72	78·0	31	51·5	19	0	0
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	80·0	31	43·0	19	0	..
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	78·0	31	43·0	5†	0	0
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	80·6	31	45·8	19	0	0
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	78·0	31	41·0	5	0	..
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	76·0	28	47·0	30	0	0
Tighnabruaich	*Argyll*	55 55	5 14	50	74·0	31	42·0	18	0	..
Mull (Quinish)	,,	56 36	6 13	35	71·0	31	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	79·2	31	43·0	19	0	..
Braemar	*Aberdeen*	57 0	3 24	1114	...	..	...	...	...	..
Aberdeen (Cranford)	,,	57 8	2 7	120	81·0	31	40·0	18	0	.
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	..
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	.
Dunrobin Castle	*Sutherland*	57 59	3 56	14	70·0	29, 30	38·5	23	0	...
Castletown	*Caithness*	58 35	3 23	100	77·5	31	43·0	12, 16	0	0
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	78·0	31	51·0	9, 17	0	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	74·5	7	42·0	19	0	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	70·0	1, 3, 12	44·0	18	0	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	..
Dublin (FitzWilliam Square)	*Dublin*	53 21	6 14	54	77·0	31	49·1	19, 30	0	0
Ballinasloe	*Galway*	53 20	8 15	160	78·0	31	41·0	19‡	0	..
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	..
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	..
Seaforde	*Down*	54 19	5 50	180	74·0	5, 22	45·0	18	0	0
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	..
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	80·0	31	46·0	8	0	0

† and 25, 30. ‡ and 30, 31.

RAINFALL FOR AUGUST, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.	Mean Annual 1870-1899.	STATION.
in.	in.	in.		in.	Date.		in.	in.	in.		in.	
2·33	·87	—1·46	37	·29	17	8	15·45	12·96	—2·49	84	25·16	Camden Square
2·37	·61	—1·76	26	·17	24	6	16·18	13·33	—2·85	82	28·36	Tenterden
2·60	·73	—1·87	28	·23	25	9	17·83	17·40	— ·43	98	29·93	West Dean
2·09	1·13	— ·96	54	·33	13	11	16·06	14·38	—1·68	90	27·10	Hartley Wintney
2·26	·88	—1·38	39	·24	24	9	15·07	13·89	—1·18	92	24·66	Hitchin
2·53	1·16	—1·37	46	·33	2	10	16·58	14·64	—1·94	88	26·75	Addington
2·40	·79	—1·61	33	·27	13	8	15·63	15·09	— ·54	96	25·39	Westley
2·19	1·25	— ·94	57	·27	8	10	15·01	17·56	+2·55	117	25·40	Brundall
3·18	·79	—2·39	25	·20	24	13	22·32	23·34	+1·02	105	39·00	Winterbourne Stpltn
2·91	1·91	—1·00	66	·42	1	13	20·69	18·05	—2·64	87	35·00	Torquay
3·19	2·91	— ·28	91	·77	1	18	21·57	24·52	+2·95	114	38·85	Polapit Tamar
2·96	1·94	—1·02	66	·62	15	13	18·82	16·70	—2·12	89	30·75	Bath
2·83	·94	—1·89	33	·27	3	10	18·56	15·58	—2·98	84	29·85	Stroud
3·24	2·69	— ·55	83	·87	7	15	20·21	17·00	—3·21	84	33·04	Woolstaston
2·46	·96	—1·50	39	·30	24	10	15·41	13·87	—1·54	90	24·50	Bromsgrove
2·25	2·39	+ ·14	106	·95	8	11	14·45	13·56	— ·89	94	23·30	Boston
2·31	1·46	— ·85	63	·39	24	14	15·63	12·20	—3·43	78	24·70	Hodsock Priory
2·42	·92	—1·50	38	·30	24	14	16·53	13·12	—3·41	79	26·18	Derby
4·36	6·57	+2·21	151	1·38	16	19	25·23	31·24	+6·01	124	42·43	Bolton
2·59	2·85	+ ·26	110	·60	10	15	16·83	16·36	— ·47	97	26·96	Ribston Hall
5·43	5·10	— ·33	94	·81	15	20	36·87	42·16	+5·29	114	60·96	Arncliffe Vic.
2·81	2·04	— ·77	73	·60	24	17	16·55	14·10	—2·45	85	27·02	Hull
3·14	3·42	+ ·28	109	·83	24	22	17·40	17·80	+ ·40	102	27·99	Newcastle
1·23	12·93	+1·70	115	2·65	12	22	77·96	84·80	+6·84	109	132·68	Seathwaite
4·52	3·47	—1·05	77	·70	24	20	25·23	28·02	+2·79	111	42·81	Cardiff
4·04	6·74	+2·70	167	1·78	1	16	27·41	31·25	+3·84	114	47·88	Haverfordwest
4·60	4·41	— ·19	96	·66	12	17	26·46	30·96	+4·50	117	45·41	Gogerddan
2·86	4·14	+1·28	145	1·37	2	18	17·65	20·68	+3·03	117	30·98	Llandudno
4·10	8·74	+4·64	213	1·62	2	18	26·15	31·17	+5·02	119	43·43	Cargen
3·42	5·67	+2·25	166	·82	12	21	20·56	22·50	+1·94	109	33·04	Riddell House
...	5·08	...	...	·95	2	18	...	19·80	..	...	...	Edinburgh
3·98	3·48	— ·50	87	·77	24	18	26·11	24·86	—1·25	95	44·85	Colmonell
3·79	5·28	+1·49	140	·90	10	23	22·09	25·53	+3·44	116	35·80	Glasgow
5·13	4·91	— ·22	96	·60	2, 21	21	34·11	40·64	+6·53	119	57·90	Tighnabruaich
4·84	3·55	—1·29	73	·58	19	21	33·06	30·83	—2·23	93	57·53	Quinish
3·08	4·65	+1·57	151	1·20	2	21	18·20	16·40	—1·79	90	28·95	Dundee
3·83	2·87	— ·96	75	...	...	...	21·66	21·48	— ·18	99	36·07	Braemar
3·22	3·56	+ ·34	111	·71	2	18	19·93	20·05	+ ·12	101	33·01	Aberdeen
3·07	3·15	+ ·08	103	·57	24	20	18·33	19·29	+ ·96	105	29·37	Cawdor
4·19	4·75	+ ·56	113	1·15	2	13	32·69	35·15	+2·46	107	56·00	Invergarry
6·91	4·94	—1·97	71	·60	19	23	49·41	59·66	+10·25	121	86·50	Bendamph
2·65	3·37	+ ·72	127	·41	24	18	18·92	25·01	+6·09	132	31·60	Dunrobin Castle
...	2·76	..	...	·77	3	22	...	23·23	...	...	...	Castletown
4·92	2·84	—2·08	58	·31	24	20	34·90	29·60	—5·30	85	58·11	Killarney
3·71	2·34	—1·37	63	·71	24	13	24·00	21·01	—2·99	88	39·30	Waterford
3·79	3·46	— ·33	91	·52	1	21	20·85	24·85	+4·00	119	33·47	Hurdlestown
3·51	2·04	—1·47	58	·42	24	14	21·56	18·36	—3·20	85	34·44	Carlow
3·02	1·76	—1·26	58	·38	3	17	17·53	15·42	—2·11	88	27·75	Dublin
3·96	4·07	+ ·11	103	·79	1	25	23·19	26·36	+3·17	114	37·04	Ballinasloe
7·90	5·85	—2·05	74	·90	14	23	48·34	46·85	—1·49	97	80·23	Kylemore House
4·57	4·53	— ·04	99	·84	23	21	29·90	33·97	+4·07	114	50·50	Enniscoe
3·52	3·85	+ ·33	109	·79	24	20	23·84	21·78	—2·06	91	38·61	Seaforde
3·94	5·93	+1·99	151	·74	24	23	24·48	28·97	+4·49	118	41·20	Londonderry
4·03	4·43	+ ·40	110	·90	1, 24	24	23·28	27·67	+4·39	119	37·85	Omagh

SUPPLEMENTARY RAINFALL, AUGUST, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	·74	XI.	Rhayader, Tyrmynydd	5·65
,,	Ramsgate, West Cliff Villas	·63	,,	Lake Vyrnwy	6·83
,,	Hailsham	1·44	,,	Llangyhanfal, Plâs Draw	2·58
,,	Crowborough, Uckfield Lodge	1·71	,,	Criccieth, Talarvor	6·30
,,	Osborne, Newbarn Cottage.	·87	,,	Llanberis, Pen-y-pass	16·62
,,	Emsworth, Redlands	1·37	,,	Lligwy	5·47
,,	Alton, Ashdell	1·91	,,	Douglas, Woodville	4·38
,,	Newbury, Welford Park	·90	XII.	Stoneykirk, Ardwell House	4·11
III.	Harrow Weald, Hill House.	·81	,,	Dalry, The Old Garroch	6·57
,,	Oxford, Magdalen College..	·86	,,	Langholm, Drove Road	8·62
,,	Bloxham Grove	1·00	,,	Moniaive, Maxwelton House	6·33
,,	Pitsford, Sedgebrook	·82	XIII.	N. Esk Reservoir [Penicuick]	6·55
,,	Huntingdon, Brampton	1·02	XIV.	Maybole, Knockdon Farm..	4·90
,,	Wisbech, Bank House	2·26	XV.	Campbeltown, Witchburn	3·79
IV.	Southend Water Works	·40	,,	Inveraray, Newtown	6·28
,,	Colchester, Lexden	·45	,,	Ballachulish House	6·75
,,	Newport, The Vicarage	·91	,,	Islay, Eallabus	4·16
,,	Rendlesham	·46	XVI.	Dollar Academy	5·61
,,	Swaffham	2·10	,,	Loch Leven Sluice	5·57
,,	Blakeney	1·74	,,	Balquhidder, Stronvar	...
V.	Bishops Cannings	1·55	,,	Perth, Pitcullen House	4·48
,,	Ashburton, Druid House	2·84	,,	Coupar Angus Station	4·65
,,	Okehampton, Oaklands	2·74	,,	Blair Atholl	4·12
,,	Hartland Abbey	2·32	,,	Montrose, Sunnyside Asylum	3·91
,,	Lynmouth, Rock House	2·90	XVII.	Alford, Lynturk Manse	3·31
,,	Probus, Lamellyn	2·22	,,	Keith Station	3·66
,,	Wellington, The Avenue	1·33	XVIII.	N. Uist, Lochmaddy	...
,,	North Cadbury Rectory	2·23	,,	Alvey Manse	4·67
VI.	Clifton, Pembroke Road	2·63	,,	Loch Ness, Drumnadrochit.	3·16
,,	Moreton-in-Marsh, Longboro'	1·30	,,	Glencarron Lodge	6·48
,,	Ross, The Graig	·91	,,	Fearn, Lower Pitkerrie	3·81
,,	Shifnal, Hatton Grange	1·59	XIX.	Invershin	3·34
,,	Cheadle, The Heath House.	2·11	,,	Altnaharra	3·24
,,	Coventry, Kingswood	1·05	,,	Bettyhill	2·17
VII.	Market Overton	·84	,,	Watten Station	1·82
,,	Market Rasen	2·19	XX.	Dunmanway, The Rectory..	3·72
,,	Bawtry, Hesley Hall	1·21	,,	Cork	1·47
VIII.	Neston, Hinderton	2·76	,,	Darrynane Abbey	3·60
,,	Southport, Hesketh Park	2·96	,,	Glenam [Clonmel]	1·88
,,	Chatburn, Middlewood	4·57	,,	Ballingarry, Gurteen	2·69
,,	Cartmel, Flookburgh	4·66	,,	Miltown Malbay	4·84
IX.	Langsett Moor, Up. Midhope	2·72	XXI.	Gorey, Courtown House	1·99
,,	Scarborough, Scalby	2·69	,,	Moynalty, Westland	4·11
,,	Ingleby Greenhow	2·38	,,	Athlone, Twyford	3·97
,,	Mickleton	2·82	,,	Mullingar, Belvedere	2·64
X.	Bardon Mill, Beltingham	4·71	XXII.	Woodlawn	4·75
,,	Ewesley, Fallowlees	5·16	,,	Westport, Murrisk Abbey..	3·79
,,	Ilderton, Lilburn Cottage	4·48	,,	Collooney, Markree Obsy..	4·59
,,	Keswick, York Bank	5·16	XXIII.	Enniskillen, Portora	...
XI.	Llanfrechfa Grange	2·51	,,	Warrenpoint, Summer Hill.	4·85
,,	Treherbert, Tyn-y-waun	6·84	,,	Banbridge, Milltown	4·09
,,	Carmarthen, The Friary	5·17	,,	Belfast, Springfield	5·47
,,	Castle Malgwyn [Llechryd].	5·49	,,	Bushmills, Dundarave	3·98
,,	Plynlimon	8·75	,,	Stewartstown, The Square..	4·33
,,	Tall-y-llyn	8·00	,,	Killybegs	6·03
,,	New Radnor, Ednol	2·54	,,	Horn Head	5·53

METEOROLOGICAL NOTES ON AUGUST, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Another dry and warm month, being, with two exceptions, the warmest August in the record of 49 years and 3°·7 more than the average. A heavy TS on the 2nd brought little R, but there was a magnificent display of lightning lasting for several hours. Brilliant weather at the beginning and end of the month, but unsettled in the middle, when the aspect at times became very threatening. Mean temp. 65°·8. Duration of sunshine 196·9* hours and of R 7·6 hours.

DORKING.—Month has continued dry and very hot. Harvest operations were finished by 25th, an unusually early date.

OSBORNE.—Fine and warm generally, with very little R.

WINTERBOURNE STEEPLETON.—A very dry August; smallest R since record began in 1893, and 2·39 in. below the average. Mean temp. about 1° above average.

TORQUAY.—Mean temp. 62°9, or 1°·4 above average. Sunshine 224·5* hours, or 18·0 hours above the average.

NORTH CADBURY RECTORY.—1st to 25th generally cloudy, warm and humid; 26th to 31st brilliant and increasingly hot. First summerlike August since 1899. R least since 1900. No T or L.

ROSS.—Very dry; R 1·42 in. Max. temp. 91°·5 on 31st; min. 42°·1 on 30th.

WORKSOP, HODSOCK PRIORY.—Mean temp. higher than that of last 27 Augusts except that of 1893; August, 1899, had warmer days but a lower mean. Max. temp. 91°·8 on 31st, min. 40°·6 on 30th. R ·85 in. below the average.

BOLTON.—Temperature above normal; sunshine above average, only one day being sunless. R 2·21 in. above average. Severe TSS on 14th and 15th.

SOUTHPORT.—Sunny and warm; mean temp. 61°·2 or 1°·9 above average. Total sunshine 208·8 hours, or 28·7 hours above average. Total duration of R 40·8 hours; amount of R 2·96 in. at Hesketh Park, 3·70 in. at Birkdale, the difference being due to a TS. Much ozone.

LILBURN.—Very unsettled; R excessive. Frequent TSS; very severe TS on night of 2nd, with loss of life. Hot spell set in on 28th.

CARMARTHEN.—Unsettled and changeable during first three weeks, but very hot during last few days. Corn crops much injured by heavy R. Grass plentiful.

HAVERFORDWEST.—Rainfall considerable; on 1st, 2nd and 12th very heavy falls occurred. High temp. towards end of month with much fog. Barn crops very good, but potato disease very prevalent.

DOUGLAS.—Variable weather, with only a few days of real summer, and unusual prevalence of sea fog up to 9th, then wet, cold and gloomy till 24th; last week very beautiful, with brilliant sunshine and high temp. Harvest work made great progress.

DUMFRIES.—Wettest August since observations commenced in 1860. Heavy R on 2nd, accompanied by severe T and L. Harvest operations sadly delayed. Potato disease very prevalent; grass abundant.

ABERDEEN.—First three weeks wet, with little sunshine; last week dry and clear with max. temperature in shade from 75° to 81°.

CASTLETOWN.—Damp and cloudy, with more fog but less R than usual in August. Last few days of month very close and warm.

BROADFORD, HURDLESTOWN.—Damp, warm and muggy. Last few days very fine and of great use to farmers.

DUBLIN.—A warm but changeable and showery month. Last week was settled, summerlike and very warm. Mean temp. 63°·1. TSS on 3rd and 16th; H on 3rd.

* Campbell-Stokes.

Climatological Table for the British Empire, March, 1900.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	65·1	7	27·3	23	49·9	35·8	36·9	83	103·2	21·7	1·08	17	5·7
Malta	73·2	22*a*	43·1	25	63·3	50·6	48·0	79	...	37·4	·26	4	3·5
Lagos	93·0	22*b*	72·0	7	90·7	78·6	75·1	67	142·0	66·0	1·11	4	4·6
Cape Town	97·3	2	52·1	15	77·5	60·5	57·0	68	...	...	·73	6	4·1
Durban, Natal	89·1	15	61·2	3	81·4	66·0	...	...	146·3	...	4·61	17	5·7
Johannesburg (!)	82·0	4	43·9	29	70·4	52·2	52·8	83	154·2	39·5	3·41	13	4·5
Mauritius	88·5	3	69·7	26*f*	85·2	73·7	73·5	85	157·2	64·6	11·08	19	8·1
Calcutta	92·9	29*c*	51·7	1	86·2	67·7	66·6	72	157·3	47·2	2·08	3	4·2
Bombay	90·8	2	67·7	13	84·4	71·5	67·8	73	138·2	59·9	·00	0	1·4
Madras	92·4	19	67·7	3	88·5	71·6	70·9	77	145·1	64·1	·00	0	2·3
Kodaikanal	74·2	26	46·9	3	69·0	50·7	44·9	60	141·7	34·4	2·79	4	3·3
Colombo, Ceylon	93·4	1	72·8	2,3	89·4	75·9	73·4	78	154·0	69·0	4·42	10	3·8
Hongkong	80·1	21	48·2	7	65·9	58·1	56·0	79	129·1	...	2·63	15	8·7
Melbourne	90·0	9	45·7	4	73·6	54·7	53·0	71	147·0	38·1	3·79	11	5·3
Adelaide	93·7	19	48·0	22	78·1	58·3	52·8	60	152·1	43·0	2·36	7	5·0
Coolgardie	100·0	8	44·9	17	87·3	58·8	48·3	42	157·0	38·2	·04	1	1·6
Sydney	91·0	2	53·0	15	74·6	61·6	57·7	72	132·1	48·1	4·23	29	5·9
Wellington	71·8	5	40·0	27	63·1	50·9	49·3	81	125·0	35·0	3·72	12	7·0
Auckland	74·0	2*d*	49·0	8, 28	68·5	55·7	54·3	76	139·0	40·0	1·80	12	5·4
Jamaica, Negril Point	88·6	18	65·2	20	84·3	69·9	69·7	78	...	...	5·36	13	...
Trinidad	99·0	24*e*	60·0	27	89·7	66·8	69·8	78	165·0	58·0	·73	5	...
Grenada	86·4	13	70·4	20	84·4	72·8	67·3	69	150·0	...	1·59	15	3·4
Toronto	49·7	27	0·2	23	32·6	21·0	21·0	79	76·0	—5·5	2·55	14	6·6
Fredericton	52·3	30	—15·3	19	36·4	10·2	9·0	53	...	...	5·00	12	4·6
Winnipeg	53·4	29	—19·5	13	27·1	5·0	...	...	...	...	·54	5	3·9
Victoria, B.C.	63·0	8	21·2	15	51·7	37·2	...	...	...	...	·67	9	6·3
Dawson	48·0	29	—16·0	18	22·5	1·2	...	...	...	...	·22	3	3·3

a and 27. *b* and 23, 24. *c* and 30. *d* and 14, 15. *e* and 30. *f* and 31.

MALTA.—Adopted mean temp. of air 55°·6, or 0°·6 above the average. Mean hourly velocity of wind 11·1 miles, or 0·9 below average. Mean temp. of sea 61°·0.

Mauritius.—Mean temp. of air 1°·3, dew point 2°·9, and R 1·86 in. above averages. Mean hourly velocity of wind 7·3 miles, or 3·1 below average.

MADRAS.—Temperature below the average. Bright sunshine 248·4 hours.

KODAIKANAL.—Bright sunshine 243 hours.

COLOMBO.—Mean temp. of air 82°·6, or 0°·5 above, of dew point 0°·5 above, and R ·27 in. below, averages. Mean hourly velocity of wind 6·1 miles.

HONGKONG.—Mean temp. of air 61°·6. Bright sunshine 71·0 hours. Mean hourly velocity of wind 16·1 miles.

Adelaide.—Mean temp. of air 68°·8, or 1°·3 below, and R 1·32 in. above, averages.

Sydney.—Mean temp. of air 1°·2 below, humidity 3°·9 below, and R ·92 in. below, averages.

Wellington.—Mean temp. of air 3°·5 below, and R ·33 in. above averages.

Auckland.—Mean temp. of air 3° below, and R a little more than half the average.

Trinidad.—R 1·19 in. below 43 years' average.

Symons's
Meteorological Magazine.

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THE RAINFALL OF THE SUMMER HALF YEAR, 1906.

The summer of 1906 will be remembered for the great duration of sunshine, the moderate and in many places seriously deficient rainfall, and the remarkable period of great heat at the end of August and beginning of September. September was on this occasion undoubtedly a continuation of summer, and at its close it is appropriate to look back at the weather of the past half year viewed as a whole. To do so for the whole range of meteorological phenomena is at the moment impracticable, and we must content ourselves with one of the elements—rainfall.

Detailed Tables have been published in these pages every month, from which it is easy to see how the rainfall varies from place to place, and in what relation it stands to the average. Though the number of stations utilized is only 52, they are so well distributed that when meaned in groups they afford something more than an indication, if something less than an absolute measure, of the general fall for the larger regions of the British Isles. Derived from the published figures the general rainfall of the six months of the summer half year appears as follows, in percentages of the average :—

1906.	April.	May.	June.	July.	August.	Sept.	Six months.
England and Wales.....	54	132	101	36	74	39	69
Scotland.....	90	209	49	83	117	52	97
Ireland	90	147	66	81	89	40	82
British Isles	71	154	81	57	88	42	79

This little table shows that of the six months, only one had rainfall above the average over the whole country, viz.—May. England and Wales had also technically more than the average in June, and Scotland in August. The driest month was September, when the rainfall for the British Isles as a whole was less than half the average amount, and in England did not much exceed one-third of the average. The rainfall of September did not approach the average

at any station we have to consider, and only in the extreme west and north of Scotland, and in the extreme south-east of England, did it substantially exceed half the average. The driest area was in the south-east of Scotland and in the north-east of England, in a strip of country bordering the east coast from the Forth to the Humber. It was very dry also along the estuary of the Severn, and the Tables at the end of this number show several instances of extremely small falls. During September absolute droughts occurred at several stations, where no rain fell after the 16th; but neither absolute droughts nor partial droughts in the technical sense were so common as in many periods of six months with a greater total rainfall.

Each month of the six was characterized by patches of country which were relatively dry, and by patches which were relatively wet. In June, Scotland as a whole was dry, Ireland less dry, and England and Wales wet; but in every other month of the six the deficiency of rainfall was greatest in the south and east, while there was usually an excess in the north and west. Thus it happens that on taking the average of the six months, there was a distinct excess of rainfall in the extreme north of Scotland, and also in the south-west of Scotland, and in the extreme north of England. All the remainder of the British Isles was dry, but the west and north of Ireland, and the greater part of Wales, and the north of England, had not much less than the average fall. A marked deficiency was apparent only in the south-east of Ireland, and in the Midlands and south of England.

The result of this arrangement is that the area seriously affected by the reduced rainfall was practically confined to the centre and south of England. The following Table gives the total rainfall for the six months at each of the stations for which an average is available, the difference from the average in inches, and the ratio of the actual fall to the average, expressed as 100. The extremes shown are at Cargen, near Dumfries, where there was an excess of 3·70 in., the total fall being 120 per cent. of the average, and Torquay, where there was a deficiency of 7·25 in., the total fall being only 52 per cent. of the average, or scarcely more than one-half. At Derby the deficiency was 7·03 in., and as it has normally a somewhat lower rainfall than Torquay, the actual fall was only 49 per cent. of the average. Both these extreme cases were, fortunately for the country, not typical of any large area. A prolonged deficiency of rainfall in any place is one of the most serious misfortunes which can befall it, despite the vulgar error that labels rainless weather "fine." Great distress was occasioned in some parts of England, chiefly in the south-east, pasture being dried up to such an extent that cattle in many cases had to be fed by hand, as in a hard winter, and the supply of milk was seriously curtailed. At Basildon, near Billericay, in Essex, the shortage of water led to a terrible tragedy, a man and his wife having trespassed on a neighbour's land to obtain water

Rainfall of April—September, 1906.

STATION.	COUNTY.	Total Rainfall.	Difference from average. 1870–1899.	Percentage of average, 1870–1899.
Camden Square	*London*	7·72	—4·89	61
Tenterden	*Kent*	7·40	—5·30	58
West Dean	*Hampshire*	7·64	—6·03	56
Hartley Wintney	,,	7·40	—4·82	61
Hitchin	*Hertfordshire*	8·02	—4·43	64
Winslow (Addington)	*Buckinghamshire*	8·64	—4·92	64
Bury St. Edmunds (Westley)	*Suffolk*	8·15	—5·08	62
Brundall	*Norfolk*	10·13	—2·64	79
Winterbourne Steepleton	*Dorset*	10·48	—5·82	64
Torquay (Cary Green)	*Devon*	7·98	—7·25	52
Polapit Tamar [Launceston]	,,	10·84	—5·24	67
Bath	*Somerset*	9·42	—5·71	62
Stroud (Uptield)	*Gloucestershire*	8·18	—6 65	55
Church Stretton (Woolstaston)	*Shropshire*	9·70	—6·16	61
Bromsgrove (Stoke Reformatory)	*Worcestershire*	8·95	—3·88	70
Boston	*Lincolnshire*	7·77	—4·48	63
Worksop (Hodsock Priory)	*Nottinghamshire.*	7·02	—5·92	54
Derby (Midland Railway)	*Derbyshire*	6·72	—7·03	49
Bolton (Queen's Park)	*Lancashire*	19·20	—1·48	93
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	9·41	—4·58	67
Arncliffe Vicarage	,, ,,	21·98	—3·92	85
Hull (Pearson Park)	,, *E.R.*	8·97	—4·53	66
Newcastle (Town Moor)	*Northumberland*	13·67	— ·45	97
Borrowdale (Seathwaite)	*Cumberland*	50·54	—3·32	94
Cardiff (Ely)	*Glamorgan*	14·41	—5·13	74
Haverfordwest (High Street)	*Pembroke*	18·17	—1·59	92
Aberystwyth (Gogerddan)	*Cardigan*	17 31	—3·52	83
Llandudno	*Carnarvon*	11·42	—2·64	81
Cargen [Dumfries]	*Kirkcudbright*	22·39	+3·70	120
Lilliesleaf (Riddell House)	*Roxburgh*	17·07	+1·15	107
Colmonell (Clachanton)	*Ayr*	15·77	—3·05	84
Glasgow (Queen's Park)	*Renfrew*	15·80	—1·52	91
Tighnabruaich	*Argyll*	26·77	+1·92	108
Mull (Quinish)	,,	21·13	—2·82	88
Dundee (Eastern Necropolis)	*Forfar*	13·65	— ·97	93
Braemar	*Aberdeen*	13·52	—3·38	80
Aberdeen (Cranford)	,,	14·61	—1·18	93
Cawdor (Budgate)	*Nairn*	12·81	—2·37	84
Invergarry	*E. Inverness*	20·52	— ·94	96
Loch Torridon (Bendamph)	*W. Ross*	32·96	—2 83	92
Dunrobin Castle	*Sutherland*	16·00	+1·85	113
Killarney (District Asylum)	*Kerry*	17·35	—6·18	74
Waterford (Brook Lodge)	*Waterford*	12·30	—4·87	72
Broadford (Hurdlestown)	*Clare*	15·71	— ·74	95
Carlow (Browne's Hill)	*Carlow*	10·13	—6·21	62
Dublin (Fitz William Square)	*Dublin*	8·83	—4·86	64
Clifden (Kylemore House)	,,	29·57	—5 88	83
Crossmolina (Enniscoe)	*Mayo*	20·08	— ·98	95
Seaforde	*Down*	14·73	—3·32	82
Londonderry (Creggan Res)	*Londonderry*	17·36	—1·54	92
Omagh (Edenfel)	*Tyrone*	17·67	— ·86	95

from a pond, when their own supply failed, were shot and killed, it is alleged, by the sons of the tenant of the farm, who had barely enough for his cattle.

From the beginning of the year the general rainfall for the nine months naturally shows a smaller deficiency than the six months considered above, because January was very wet everywhere. The approximate values for 1906 to the end of September are:—England and Wales 90 per cent. of the average, Ireland 92 per cent. of average, and Scotland 100 per cent. of average. It is obvious from these figures that it is too soon to say that 1906 is a dry year, for the three months to come may either increase or altogether wipe out the present deficiency.

THE METEOROLOGICAL OFFICE.

THE first Report of the Meteorological Committee for the year ending 31st March, 1906, has been published, and it contains a good deal that is new and interesting. The report occupies 40 pp., and the appendices fill about 100 pp. The Meteorological Committee it appears was appointed by a Treasury minute dated 20th May, 1905, and held five meetings during the year; but a decision as to the form of incorporation to be ultimately adopted was not arrived at, the arrangement being that pending the settlement of the question of permanent premises the property of the Office should be vested in trustees. Otherwise the new Committee has carried on the organisation of the Office generally on the lines followed by the old Meteorological Council; but various alterations, which we have noted from time to time, have been made, and others are foreshadowed.

Various economies have been effected by the abandonment of the Ben Nevis Observatories, the abolition of the paid Council, and by more favourable arrangements with the Admiralty, and out of the savings £500 per annum have been assigned to investigations in the upper atmosphere, the experiments being organized and controlled by Mr. Dines. The objects to be kept in view in this work are (1) the maintenance of a depôt for the construction and testing of apparatus; (2) the investigation of the upper air over the British Isles by a series of simultaneous ascents with kites and unmanned balloons, at three stations if possible, on the days fixed for the international ascents; (3) the supply of apparatus for observations in the upper air for use at sea, and the instruction of the officers who may undertake such investigations.

The Committee has given attention to the question of collecting meteorological data from local authorities and private individuals, this being done not only to supply material for the official publications, but also to assist in forming a collection of meteorological data "for the purposes of scientific investigations, or the requirements of those interested in agriculture, sanitary science, or the

various industries which are affected by different conditions of weather."

Reference is made to the overlapping in the publication of monthly summaries by the various bodies concerned in collecting meteorological records in the British Isles. The Committee invited the Royal Meteorological Society and the Scottish Meteorological Society to send representatives to a Conference to endeavour to initiate a joint scheme for the collection and publication of results. One meeting of this Conference has been held and the Committee hopes that this will soon result in an agreement to the common advantage of all three institutions.

The report refers in guarded and diplomatic language to the difficulties and disabilities under which the Meteorological Office labours with regard to telegraphic service, but we who are untrammelled by the considerations which compel a public body to walk delicately in the presence of the Postmaster General, can say that the British public loses vastly more in the value of property damaged by storms—the warnings of which have been tied up and kept back by Post Office red tape—than it saves in preserving traditions of working which have grown dear to the official heart. The fishing interests in particular would do well in this matter to impress upon Parliament that the public is lord also of the Post Office. The humour of the situation is that the Post Office at present cheerfully receives and accepts payment for telegrams which it delivers after twelve, twenty-four, or even more hours; and we are told that "the representative of the Postmaster General, who went into this matter very carefully, was only able to suggest that the meteorological service should be fixed for such hours as to allow an adequate margin for the occasional pressure of ordinary business and other causes of telegraphic delay." Might he not have suggested with equal appropriateness that cyclonic storms approaching the British Isles should time their arrival so that the first indications of their proximity might be observed during the hours when it is convenient for telegraph operators to transmit and receive messages? A possible way of escape, which is not referred to in the Report, may ultimately be found through the telephone service, which curiously enough is not shut off like the telegraphs in most districts, at night or on Sundays.

A practical point of great importance is the question of the housing of the Meteorological Office. Negotiations are in progress for securing a new building on a site at South Kensington, belonging to the Government, or to the Commissioners for the Exhibition of 1851. The proximity of the University of London and the Museums is held, in the opinion of the Meteorological Committee, to outweigh the disadvantages of greater distance from "the lithographers, the city, and the docks," but the removal from Westminster, which has been a meteorological centre for many years, must cause inconvenience and regret to many other interests. There

is a tendency for the concentration of scientific as well as educational institutions in South Kensington, and the remoteness of the locality from the haunts of busy men will no doubt be counterbalanced by solid advantages.

The institution of monthly meteorological charts for the Indian Ocean and the Red Sea is announced, and a brief summary is given of the various scientific researches which have been promoted by the late Meteorological Council and the present Committee, researches all of them of great interest and likely to lead to practical results, and of a nature which certainly ought to be aided largely by public money.

The appendices contain correspondence with the Treasury on various points connected with the organization of the Meteorological Committee, and the work of the Meteorological Office, also lists of marine observers, and of observers at land stations, together with sundry other matters of routine. Space is saved, as compared with former reports, by the omission of the long list of additions to the Library, the more important of which are referred to in the body of the Report.

Altogether the record of the first year's work of the re-organized Office strikes us as extremely satisfactory, showing a spirit of progress, and a relaxation of the extreme formality which is so apt to impair the usefulness of public service.

RADIATION PHENOMENA IN SOUTH AFRICA.

By James Lyle.

As the average height of the Orange River Colony is over 4000 ft., the surface practically bare, and the air excessively dry, all local phenomena dependent on radiation from the sun and from the ground must be striking, even if not novel. As your Magazine circulates throughout other parts of South Africa, where similar conditions prevail, a few notes on some such phenomena may interest some of your readers.

The sequence of the following phenomena is fairly constant, though relative intensities depend on the season of the year. As soon as the sun sets the temperature falls very rapidly, especially on the tops of the kopjes, which, as they are the remains of an old land surface, are often quite flat, with a slight dip. The cooled air flows down from them on to the present general surface of the land, by the same law as water flows. This is most noticeable when smoke is being produced on the top of the kopje. At Bloemfontein the military cantonments are on a kopje, and at sunset one can trace by the smoke a complete river system of cold air wending its way into the basin in which the city lies. Channel, tributaries, divides, are all distinctly marked. The hot air floats upward and in a few hours the air on the top of the kopje becomes several degrees

warmer than the air below. In consequence it is more comfortable to bivouac on a kopje than on the level. Young trees suffer more from frost in the valleys than on the kopjes. The transition is often quite marked, both vertically on ascending a kopje, and horizontally on passing through a river of cold air.

Recently it was my unfortunate experience to have to catch a train at 2.30 a.m., and to be roused again at sunrise. On looking to the west, towards a line of kopjes, I saw what on closer examination proved to be a mirage inverted. The text books give it another name but I think this is the best name for it. The kopjes were fully eight miles away and about 300 feet high. The light from them must have struck the base of the hot air which had risen the previous evening and being totally reflected gave us an inverted image of the kopjes, with the top of the kopje touching its own image. The phenomenon lasted about fifteen minutes.

By eight or nine o'clock when the sun has had time to heat the ground surface and the adjacent layer of air, often not so much as a foot in depth, we see the usual mirage where the images of kopjes and sky are seen under the real objects. On the field of Sannah's Post I have seen such a reflection of cattle only a few hundred yards distant. The reflecting layer seemed to be about the level of their knees as it was there that image and object touched. The movement of the hot air gave a quivering image such as one sees in pools whose surface is crossed by ripples. Later in the day, as this hot air gathers head, it bursts upward through the over-lying colder air in dust-whirls, rotating as accident decides, but always drifting up the slope of the heated land. The whirls vary in size from a few inches in diameter to a hundred feet, and in intensity from harmless spirals up to those which well merit the name of dust devils. They advance slowly at the rate of about six miles an hour as a maximum, but the speed of rotation is very great Fifty or sixty miles an hour is quite common.

Near midday other ascending currents show themselves in the formation of Cumulus clouds, which, especially in summer, are a feature of the afternoons. As evening draws on the clouds settle down and disappear. This almost daily series of up and down currents seems by its rhythm to have a cumulative effect and at length to become unstable and to terminate in a violent afternoon squall of dust, thunder, lightning, rain and even hail.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

PHOTOGRAPHIC SUNSHINE RECORDERS.

I READ with concern the remarks on Photographic Sunshine Recorders which appear in your article, "Local Societies and Meteorology," on p. 142.

As I believe I am the originator of the photographic method, I may perhaps say that I think the remarks seem somewhat severe when applied to all photographic sunshine recorders.

The photographic method doubtless has defects, as also has the Campbell-Stokes burning method, but, I think, in all fairness both may claim to give faithful records of the duration of bright sunshine.

Referring more particularly to my own instrument, the official report of a comparison between it and the "Campbell-Stokes" recorder at the Kew Observatory in 1887 certified that, "after a month's trial, the results were practically identical, the difference between the two records being less than one per cent." These experiments were made when the "Jordan" recorder was first brought out, but since that date the instrument has been much improved, and the method of preparing the charts has likewise been modified so as to render them equally sensitive at all times and to ensure that only bright sunshine is recorded.

I may add that I have now no pecuniary interest in the instrument, the patent rights having long since lapsed.

JAMES B. JORDAN.

"*Hayfield,*" *Hythe, Kent, October 4th, 1906.*

[We should be glad to have the opinions of our readers on the relative merits of the photographic and burning sunshine recorders. For our own part we feel that the action of the Meteorological Office in making the Campbell-Stokes instrument the standard for comparison between different stations renders it highly desirable that that form should be generally adopted. The ingenuity and simplicity of Mr. Jordan's recorder are beyond praise, and for comparing the sunshine of one day with another at the same station, so long as the sensitized paper retains its properties unimpaired no better instrument need be desired. The difficulty is that different supplies of the sensitized paper often differ in their degree of sensitiveness, so that the records vary in length for the same amount of sunshine. We are glad to learn that a method has been found for overcoming this difficulty, and suggest that a fresh series of comparisons between the Campbell-Stokes recorder and the Jordan recorder, furnished with cards prepared at different times and by different makers, should now be instituted.—ED. *S.M.M.*]

UNBROKEN RUN OF DAYS WITH SUNSHINE.

As an illustration of the exceptional summer of 1906, I give below the longest continuous run of sunny days in the last nine summers at Slough, Bucks :—

1898	.....	53 days without a break.
1899	.....	70 ,, ,, ,,
1900	.....	64 ,, ,, ,,
1901	.....	105 ,, ,, ,,
1902	.....	34 ,, ,, ,,
1903	.....	71 ,, ,, ,,
1904	.....	80 ,, ,, ,,
1905	.....	60 ,, ,, ,,
1906	.....	119 ,, ,, ,,

RICHARD BENTLEY.

Upton, Slough.

[At Camden Square the number of consecutive days recording sunshine from June 16th to October 1st was 108.—Ed. *S.M.M.*]

THE DROUGHT.

In case you think it worth publishing as a contrast to Mr. Horner's statistics of a remarkable drought in the south of England, I send you my rainfall return for the same three months in the same form :—

JUNE.	in.	JULY.	in.	AUGUST.	in.
1	·06	6	·03	1	·19
14	·01	10	·01	3	·07
15	·03	11	·03	4	·03
16	·58	13	·18	5	·06
17	·09	15	·01	10	·12
23	·98	18	·17	11	·03
27	·14	21	·12	12	·01
28	1·40	22	·02	13	·02
		23	·28	14	·48
		26	·20	15	1·64
		28	·47	16	·28
				17	·12
				20	·01
				23	·19
				24	·67
				25	·02
Totals	3·29		1·52		3·94
No. of days	8		11		16

Total for the 3 months, 8·75 in.

WALDEGRAVE.

Chewton Priory, Bath, September 21st, 1906.

THE GREAT HEAT.

To compare with other readings that appear in the current number of your Magazine you may be interested in the following records of my thermometers here (they are Kew certificated).

		max.		min.
		°		°
Aug.	31	89·9		58·0
Sept.	1	86·1		56·8
,,	2	88·9		57·9
,,	3	91·4		59·0

I cannot help thinking the last maximum must constitute pretty well a record for this part of East Anglia where, however, my own observations have only covered 5 years; during this period my next highest reading was only 87·9 on August 4th, 1904. It is curious to observe that the heat did not culminate here until September 3rd, which was the hottest day. Generally, over England, this day seems to have been materially cooler than the preceding 3 days. Note also that the night minima were not excessively high.

Rookwood, Copdock, Ipswich, 24th Sept., 1906. F. H. BLAND.

A CONTRAST IN SUMMER RAIN.

I ENCLOSE the total rainfall registered here for the four hottest months of the year, also for comparison's sake, that of three years ago. The low summer rainfall following a dry spring (March, April and May only yielding 3·90 inches), has been rather severe on surface rooting trees and shrubs.

	1906 in.		1903 in.
June	1·36	.....	6·36
July	1·03	.....	6·36
Aug.	·40	.....	3·64
Sept.	1·60	.....	2·19
Totals	4·39		18·55

T. W. BACON.

Ramsden Hall, Billericay, 1st October, 1906.

METEOROLOGICAL NEWS AND NOTES.

AN INTERNATIONAL POLAR CONGRESS was convened at Brussels by the Belgian Government in the beginning of September. Most of the countries of Europe (the United Kingdom, Austria-Hungary and Norway being the only prominent exceptions) were officially represented, and various resolutions were drawn up to favour the resumption of Arctic and Antarctic exploration. Meteorology, as one of the sciences which has most to learn from polar exploration, was well to the front. Prof. Rykatcheff of St. Petersburg, M. Angot of Paris, M. Lancaster and M. Lecointe of Brussels, Prof. E. Hermann of Hamburg, Dr. Meinardus of Berlin, Prof. Von der Stok of de Bilt, Dr. H. R. Mill of London (representing the Royal Meteorological Society), and Mr. R. C. Mossman of Edinburgh, were amongst the meteorologists present.

A SEVERE TYPHOON burst upon Hong Kong on September 18th, causing the loss of several ships and a great many lives as well as doing much damage on shore. It is stated that no warning of this storm was issued by the Hong Kong Observatory, and that the Governor has appointed a Committee to inquire into the matter. A telegraph agency announces that the typhoon had been foreseen at the Jesuit Observatory at Zi-ka-wei, and warnings were issued, though no warning was sent to Hong Kong "because for years the Hong Kong Observatory has refused to exchange warnings with the Jesuit Observatories at Shanghai and Manila." Rumours of such a state of affairs have been heard before, and it is to be hoped that the Governor's Committee of Inquiry will settle the matter definitely. It is difficult to understand any circumstances which could justify the suspension of a free exchange of observations and warnings, and we must hope that the statements which have been published are erroneous.

DR. G. C. SIMPSON Lecturer on Meteorology in the University of Manchester has been appointed, we learn from *The Times*, assistant to the Director of Observatories under the Indian Government. Dr. Simpson's work in the study of the upper air by means of kites in the North Sea will be remembered by our readers, and he has assisted in establishing the kite observations in Derbyshire now being conducted by the University of Manchester.

DR. H. R. MILL WILL LECTURE ON "RAIN," for the Gilchrist Trust, in the last week of November, at the following towns:—Alfreton, on November 26th; Mansfield, on the 27th; Mexborough, on the 28th; Denby Dale, on the 29th; and Glusburn, on the 30th. He hopes to meet a number of the rainfall observers in those neighbourhoods, and if time permits to inspect some of the rain gauges.

ELECTRICAL RESISTANCE THERMOMETERS for meteorological work are referred to in *Technical Thermometry*, the last catalogue of the Cambridge Scientific Instrument Company, and an interesting diagram is given showing the curve of an open-wound thermometer of this type connected with a Callandar recorder. This curve represents the fluctuations of air-temperature at Cambridge in the squall of February 8th, 1906, and indicates a drop of 9° in less than ten minutes.

A METEOROLOGICAL ADVERTISEMENT issued by a tradesman in Cape Colony takes the form of a calendar for 1906, the centre of which is occupied by a table of the monthly rainfall of the locality for the years of the 20th century, 1906 being left blank, to be filled up as the year proceeds. Above appears a statement of the average rainfall of the summer and of the winter months, and below "The time to buy ——'s pianos is winter or summer, wet or dry."

REVIEWS.

A First Report on the Relations between Climates and Crops. U.S. Department of Agriculture. Weather Bureau. By CLEVELAND ABBE. Washington: 1906. Size 9 × 6. Pp. 386. Price, $1.50.

THIS report is a summary of the results of the best experimentalists and observers upon agricultural physics and plant physiology so far as these results were published up to 1891, and presents a rapid review of the condition of our knowledge up to that year respecting the influence of climate upon wild and cultivated plants.

The author indicates that there are three methods generally recognised as advancing our knowledge of climatic influences upon vegetable life, viz., the physiological, experimental and statistical methods—the last the least satisfactory—and he has accordingly availed himself of a large number of data resulting from investigations carried out at the Botanical Institute, Würzburg, Germany, and at the agricultural experimental stations and biological laboratories in Europe and America, and from statistics compiled by the United States Department of Agriculture.

The results of investigations carried out with a view to determine the relations of special crops to special features of climate and other influences are quoted at length, together with those of experimental work in connection with the influence of low temperatures upon plant life. It appears that warm thaws act very injuriously upon many plants, including wheat, when they have been frozen at very low temperatures, whereas cold thaws effect little damage. The same applies to the germination of seeds.

Much space is given in the report to the results of phenological observations, and tables are reproduced giving for 889 species of plants studied by Karl Fritsch during the years 1857—1861, at the Botanical Garden, Vienna, the average dates for the appearance of flowers and ripened fruit and the thermal constants connected with the manifestation of these phases of plant life. The discussion by Angot of a system of phenological observations organized in 1880 by the Central Meteorological Bureau of France is also summarized. In his discussion Angot by laborious processes finds numbers showing the connection between the leafing and flowering of different species of plants with the mean daily temperatures, the mean daily maximum temperatures, and the sums of mean daily temperatures and maximum daily temperatures. The relationship, however, is not a simple one, and the numbers varied somewhat from year to year. Some species seem to be more dependent as regards their date of flowering, &c., upon the sums of mean daily temperature, others upon the sums of maximum daily temperatures reckoning from above a certain limit.

In the accumulation of data of this nature we take it that it is always the *average individuals* of each species that are selected for observation by phenologists, not the earliest ones. According to

Angot, for example, May 6th is the average date for the first appearance of leaves and flowers on the oak in the latest districts of the north of France; this is *about* the 'date' for the south of England, but on the 30th of April in the south of England fully twenty-five per cent. of the oak trees in any given area are normally already leafing and flowering and a smaller percentage as early as the 20th, whilst as late as the 12th of May fully twenty-five per cent. remain with closed leaf and flower buds, and a smaller percentage are more backward still. We refer to this question as reports on phenological observations submitted to the public are not always clear as to what kind of individuals are selected for study. L.C.W.B.

Memoirs of the Geological Survey. England and Wales. The Water Supply from underground sources of Lincolnshire, 1904.

Do. do. of Suffolk, 1906.

Do. do. of the East Riding of Yorkshire, 1906.

London. Printed for H.M. Stationery Office by Wyman & Sons, and to be purchased from E. Stanford, London; John Menzies & Co., Edinburgh; Hodges, Figgis & Co., Dublin, or from any Agent for the sale of Ordnance Survey Maps.

FROM a meteorological point of view the chief interest of this new series of Water Supply Memoirs rests on the fact that each is accompanied by a map of the average annual rainfall of the district concerned. The maps, which were prepared by Dr. H. R. Mill from the data collected by the British Rainfall Organization, are published on the scale of 10 miles to an inch, and show the average rainfall for a period of 35 years from 1868 to 1902. There are not many records in any county which run unbroken through so long a period; but there are enough to enable the relative rainfall of each year to be deduced and thus furnish ratios by which the rainfall of short periods may be corrected to the long average. The counties in question exhibit no great range in rainfall, and it has been found possible to draw isohyets or lines of equal rainfall for successive intervals of $2\frac{1}{2}$ inches. The relation to configuration is perfectly clear in all cases where observations exist, and where data are wanting it was possible to sketch the most probable distribution of rain by reference to the features of physical relief.

The following summaries may be placed on record as likely to be of general interest.

Lincolnshire.—Average general rainfall 25·25 in.

Zone. in.	Sq. miles.	Per cent. of Total Area.	General Rainfall of Zone. in.
Below 22·5	34	1·3	22·25
22·5 to 25·0	1409	53·6	24·0
25·0 ,, 27·5	898	34·2	26·0
27·5 ,, 30·0	236	9·0	28·5
Above 30·0	51	1·9	30·25
Total	2628	100·0	25·25

Suffolk.—Average general rainfall 24·50 in.

Zone. in.	Sq. miles.	Per cent. of Total Area.	General Rainfall of Zone. in.
Below 25·0	970	65·2	24·3
Above 25·0	518	34·8	25·3
Total	1488	100·0	24·5

East Riding of Yorkshire.—Average general rainfall 27·40 in.

Zone. in.	Sq. miles.	Per cent. of Total Area.	General Rainfall of Zone. in.
Below 25·0	305	25·7	24·5
25·0 to 27·5	395	33·3	26·2
27·5 ,, 30·0	228	19·3	28·5
30·0 ,, 32·5	183	15·5	31·1
Above 32·5	73	6·2	33·5
Total	1184	100·0	27·4

The Fernley Observatory, Southport. Report and Results of Observations for the year 1905. By JOSEPH BAXENDELL, Meteorologist to the Southport Corporation. Southport: 1906. Size 10 × 7½. Pp. 30.

THIS report is a pattern which any town, desiring to establish a complete meteorological observatory, would do well to follow. The instruments are clearly described and the records carefully discussed. Special interest attaches to the underground temperatures which are measured at 1, 4, 10 and 20 ft. The annual mean of each of the four lay between 49°·4 and 49°·7. The minimum at 1 ft. and 4 ft. occurred in January, at 10 ft. in March and at 20 ft. in May; the maximum at 1 ft. and 4 ft. occurred in July, at 10 ft. in August and September, and at 20 ft. in October. The range of mean monthly temperature was 28°·8 at 1 ft., 20°·5 at 4 ft., 11°·2 at 10 ft., and 3°·3 at 20 ft. A valuable feature of the report is the series of tables giving the monthly means of the principal meteorological elements for each hour of the twenty-four. We congratulate Mr. Baxendell and the Corporation of Southport on a good report of an excellent year's work, the solid scientific value of which is assured by all the safeguards that could be applied.

The State of the Ice in the Arctic Seas, 1905. Copenhagen, 1906. Size 12½ × 9½. Pp. xx.

THIS abstract from the annual report of the Danish Meteorological Institute records a unique achievement in Arctic navigation in the successful navigation of the North West Passage for the first time, by Captain Amundsen. The English of the bilingual report is hardly up to its usual standard this year, and might have been improved by revision.

The National Physical Laboratory. Report of the Observatory Department for the year 1905. Teddington : 1906. Size $10\frac{1}{2} \times 7\frac{1}{2}$. Pp. 44.

THE Report of the Observatory Department is issued separately this year as it "appeals to a different class of workers to that interested in the Engineering and Physics Department," and we welcome the change. The separate publication of the work of an observatory, a very large part of the work of which is the testing of Meteorological instruments, throws into relief the absence from the General Board of the National Physical Laboratory of any representative of any meteorological institution, or of any individual who is associated with meteorology. We have more than once had to refer to the contempt in which meteorology is held in this country by the bodies which control the nomination of such boards, and in particular to the tacit assumption that meteorology is an inferior branch of science. The subject is one on which we fear more must be said; but not on this occasion.

The instruments tested in 1905 included 35 rain gauges, 54 rain measuring glasses, 3 sunshine recorders, 244 barometers, 3,626 meteorological thermometers and 44 solar radiation thermometers. The appendix to Dr. Chree's report includes tables of meteorological data including atmospheric electricity, and also of magnetic and seismological observations, the magnetic data referring to the observations at Falmouth and Valencia as well as to Kew.

Gyroscopes and Cyclones. By F. J. B. CORDEIRO. Reprinted from American Journal of Mathematics. Vol. **28**. No. 3. [No place of publication or date.] Size $12 \times 9\frac{1}{2}$. Pp. 14.

IN this paper a cyclone is treated dynamically as a gyroscope, in other words as a rotating disc, moving on the surface of a rotating sphere. Some startling results follow, and the author suggests that moving cyclones tend to accelerate the Earth's rotation by the cumulative effect of their movement always in one direction, and that they may exercise a disturbing influence on the Earth's axis, accounting, in part at least, for the slight variations in latitude which have been detected by astronomers.

Niederschlag, Abfluss und Verdunstung auf den Landflächen der Erde. [Precipitation, Run-off and Evaporation on the land-surfaces of the Earth.] Von RICHARD FRITZSCHE. Halle : 1906. Size $9\frac{1}{2} \times 6\frac{1}{2}$. Pp. 56.

A THESIS written for the Doctors' degree in the University of Halle. It deals with data collected by a number of observers and contains references to a good deal of the literature of the subject, giving tables of the rainfall of the Earth's surface in all latitudes.

TEMPERATURE FOR SEPTEMBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [-E.]	Height above Sea.	TEMPERATURE. Max.		TEMPERATURE. Min.		No. of Nights at or below 32°	
									Shade.	Grass
		° ′	° ′	ft.	°	Date.	°	Date.		
Camden Square	*London*	51 32	0 8	111	94·0	2	39·0	28	0	0
Tenterden	*Kent*	51 4	*0 41	190	92·0	2	41·5	26, 28	0	...
West Dean	*Hampshire*	51 3	1 38	137	87·0	1	29·0	28	4	11
Hartley Wintney	,,	51 18	0 53	222	93·6	1	30·5	26†	5	7
Hitchin	*Hertfordshire*	51 57	0 17	238	92·0	1	35·0	26†	0	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	94·0	1, 2	32·0	26†	3	5
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	93·5	3	38·0	29	0	...
Brundall	*Norfolk*	52 37	*1 26	66	93·0	3	34·4	27	0	1
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	81·8	1	30·4	26	2	5
Torquay (Cary Green)	*Devon*	50 28	3 32	12	76·1	7	44·0	26	0	0
Polapit Tamar [Launceston]	,,	50 40	4 22	315	81·4	1	28·8	26	1	4
Bath	*Somerset*	51 23	2 21	67	87·8	1	34·0	28	0	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	86·0	1, 2	45·0	26	0	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	86·5	1	36·0	25, 26	0	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	90·0	1, 2	30·0	25, 27	4	...
Boston	*Lincolnshire*	52 58	0 1	25	89·0	1, 2, 3	36·0	28, 29	0	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	93·0	1, 2	30·5	28	1	11
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	94·0	2	31·0	27	1	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	87·6	2	39·1	28	0	1
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	87·0	1	36·0	29	0	4
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	88·0	1	37·1	29	0	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	..	...	..	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	78·6	1	33·3	26	0	1
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	86·0	1	31·0	25	...	...
Llandudno	*Carnarvon*	53 20	3 50	72	87·0	1	44·0	23	0	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	86·0	1	32·0	29	1	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	86·0	1	30·0	23	4	7
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	85·3	1, 2	38·1	24	0	0
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	84·6	1	31·0	28	2	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	82·0	2	36·0	30	0	7
Tighnabruaich	*Argyll*	55 55	5 14	50	...	...	37·0	16, 28	0	...
Mull (Quinish)	,,	56 36	6 13	35	82·0	2	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	83·5	2	37·9	17	0	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	82·0	1	32·0	23‡	3	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	73·0	2	38·5	25	0	...
Castletown	*Caithness*	58 35	3 23	100	83·0	2	34·0	23, 25	0	1
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	81·0	2	40·5	10	0	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	74·0	6	34·0	26	0	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	72·0	1	40·0	15	0	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	77·8	2	41·0	26	0	0
Ballinasloe	*Galway*	53 20	8 15	160	...	...	...	...	...	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	72·0	1	37·0	27	0	1
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	82·0	1	36·0	28	0	...

† and 27, 28. ‡ and 26, 29.

RAINFALL FOR SEPTEMBER, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.	Mean Annual 1870-1899.	STATION.
in.	in.	in.		in.	Date.		in.	in.	in.		in.	
2·29	1·75	— ·54	76	·81	4	8	17·74	14·71	—3·03	83	25·16	Camden Square
2·62	1·70	— ·92	65	·37	18	9	18·80	15·03	—3·77	80	28·36	Tenterden
2·58	·79	—1·79	31	·35	14	6	20·41	18·19	—2·22	89	29·93	West Dean
2·38	·81	—1·57	34	·27	14	9	18·44	15·19	—3·25	82	27·10	Hartley Wintney
2·26	1·13	—1·13	50	·39	14	10	17·33	15·02	—2·31	87	24·66	Hitchin
2·38	1·06	—1·32	45	·32	14	10	18·96	15·70	—3·26	83	26·75	Addington
2·49	1·21	—1·28	48	·41	13	9	18·12	16·30	—1·82	90	25·39	Westley
2·57	1·25	—1·32	49	·39	16	10	17·58	18·81	+1·23	107	25·40	Brundall
3·40	1·74	—1·66	51	·59	14	6	25·72	25·08	— ·64	98	39·00	Winterbourne Stpltn
3·05	·95	—2·10	31	·60	14	6	23·74	19·00	—4·74	80	35·00	Torquay
3·63	1·14	—2·49	31	·43	14	7	25·20	25·66	+ ·46	102	38·85	Polapit Tamar
2·89	·76	—2·13	26	·23	14	6	21·71	17·46	—4·25	80	30·75	Bath
2·72	·65	—2·07	24	·25	14	6	21·28	16·23	—5·05	76	29·85	Stroud
2·74	·91	—1·83	33	·44	14	6	22·95	17·91	—5·04	78	33·04	Woolstaston
2·32	·95	—1·37	41	·24	14	5	17·73	14·82	—2·91	84	24·50	Bromsgrove
2·30	·87	—1·43	38	·35	14	9	16·75	14·43	—2·32	86	23·30	Boston
2·18	·97	—1·21	45	·32	14	6	17·81	13·17	—4·64	74	24·70	Hodsock Priory
2·32	·96	—1·36	41	·37	14	6	18·85	14·08	—4·77	75	26·18	Derby
4·38	2·30	—2·08	53	·54	14	10	29·61	33·54	+3·93	113	42·43	Bolton
2·53	·58	—1·95	23	·20	14	7	19·36	16·94	—2·42	87	26·96	Ribston Hall
5·13	1·84	—3·29	36	·73	5	9	42·00	44·00	+2·00	105	60·96	Arncliffe Vic.
2·40	·73	—1·67	30	·43	14	9	18·95	14·83	—4·12	78	27·02	Hull
2·36	·58	—1·78	25	·28	13	8	19·76	18·38	—1·38	93	27·99	Newcastle
12·76	4·39	—8·37	35	1·51	5	10	90·72	89·19	—1·53	98	132·68	Seathwaite
4·08	1·20	—2·88	29	·56	14	9	29·31	29·22	— ·09	100	42·81	Cardiff
4·21	1·29	—2·92	31	·53	15	5	31·62	32·54	+ ·92	103	47·88	Haverfordwest
4·20	1·55	—2·65	37	·65	13	9	30·66	32·51	+1·85	106	45·41	Gogerddan
2·92	·71	—2·21	24	·21	11	9	20·57	21·39	+ ·82	104	30·98	Llandudno
3·71	1·08	—2·63	29	·29	13	6	29·86	32·25	+2·39	108	43·43	Cargen
2·77	·59	—2·18	21	·20	14	7	23·33	23·09	— ·24	99	33·04	Riddell House
...	·55	...	...	·13	14	8	...	20·35	..	...	...	Edinburgh
4·08	1·26	—2·82	31	·38	11	9	30·19	26·12	—4·07	87	44·85	Colmonell
3·34	1·41	—1·93	42	·44	11	9	25·43	26·94	+1·51	106	35·80	Glasgow
5·53	4·87	— ·66	88	1·67	11	11	39·64	45·51	+5·87	115	57·90	Tighnabruaich
5·47	4·44	—1·03	81	·86	5	11	38·53	35·27	—3·26	92	57·53	Quinish
2·55	1·05	—1·50	41	·25	11, 13	11	20·75	17·45	—3·29	84	28·95	Dundee
3·27	1·50	—1·77	46	...	...	...	24·93	22·98	—1·95	92	36·07	Braemar
3·04	·85	—2·19	28	·25	13	11	22·97	20·90	—2·07	91	33·01	Aberdeen
3·01	1·38	—1·63	46	·68	11	9	21·34	20·67	— ·67	97	29·37	Cawdor
5·12	3·62	—1·50	71	1·80	5	8	37·81	38·77	+ ·96	103	56·00	Invergarry
8·28	3·02	—5·26	36	2·20	5	7	57·69	62·68	+4·99	109	86·50	Bendamph
2·71	2·08	— ·63	77	1·02	11	7	21·63	27·09	+5·46	125	31·60	Dunrobin Castle
...	2·43	...	...	·70	11	14	...	25·66	...	...	...	Castletown
4·67	1·09	—3·58	23	·21	12, 16	9	39·57	30·69	—8·88	78	58·11	Killarney
3·08	1·65	—1·43	54	·52	2	7	27·08	22·66	—4·42	84	39·30	Waterford
2·94	1·35	—1·59	46	·32	14	11	23·79	26·20	+2·41	110	33·47	Hurdlestown
2·80	·81	—1·99	29	·31	2	8	24·36	19·17	—5·19	79	34·44	Carlow
2·15	·70	—1·45	33	·20	11	7	19·68	16·12	—3·56	82	27·75	Dublin
3·17	...	...	...	...	...	...	26·36	...	...	...	37·04	Ballinasloe
6·72	3·31	—3·41	49	1·02	14	11	55·06	50·16	—4·90	91	80·23	Kylemore House
4·12	1·56	—2·56	38	·32	13	15	34·02	35·53	+1·51	104	50·50	Enniscoe
3·37	·94	—2·43	28	·55	11	11	27·21	22·72	—4·49	83	38·61	Seaforde
3·77	1·49	—2·28	40	·43	14	12	28·25	30·46	+2·21	108	41·20	Londonderry
3·55	1·94	—1·61	55	·55	14	10	26·83	29·61	+2·78	110	37·85	Omagh

SUPPLEMENTARY RAINFALL, SEPTEMBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	1·85	XI.	Rhayader, Tyrmynydd	1·42
,,	Ramsgate, West Cliff Villas	1·95	,,	Lake Vyrnwy	1·28
,,	Hailsham	1·36	,,	Llangyhanfal, Plâs Draw	·80
,,	Crowborough, Uckfield Lodge	1·90	,,	Criccieth, Talarvor	1·14
,,	Osborne, Newbarn Cottage.	1·31	,,	Llanberis, Pen-y-pass	3·20
,,	Emsworth, Redlands	1·57	,,	Lligwy	1·20
,,	Alton, Ashdell	1·29	,,	Douglas, Woodville	1·62
,,	Newbury, Welford Park	1·05	XII.	Stoneykirk, Ardwell House	1·19
III.	Harrow Weald, Hill House.	1·34	,,	Dalry, The Old Garroch	1·50
,,	Oxford, Magdalen College..	·85	,,	Langholm, Drove Road	1·44
,,	Bloxham Grove	·99	,,	Moniaive, Maxwelton House	·88
,,	Pitsford, Sedgebrook	·91	XIII.	N. Esk Reservoir [Penicuick]	1·20
,,	Huntingdon, Brampton	1·02	XIV.	Maybole, Knockdon Farm..	1·44
,,	Wisbech, Bank House	·90	XV.	Campbeltown, Witchburn	2·29
IV.	Southend Water Works	1·69	,,	Inveraray, Newtown	5·22
,,	Colchester, Lexden	1·57	,,	Ballachulish House	6·28
,,	Newport, The Vicarage	1·22	,,	Islay, Eallabus	2·29
,,	Rendlesham	1·43	XVI.	Dollar Academy	2·77
,,	Swaffham	1·31	,,	Loch Leven Sluice	1·35
,,	Blakeney	·94	,,	Balquhidder, Stronvar	...
V.	Bishops Cannings	1·24	,,	Perth, Pitcullen House	1·42
,,	Ashburton, Druid House	1·09	,,	Coupar Angus Station	1·20
,,	Okehampton, Oaklands	1·35	,,	Blair Atholl	1·79
,,	Hartland Abbey	1·11	,,	Montrose, Sunnyside Asylum	1·12
,,	Lynmouth, Rock House	1·36	XVII.	Alford, Lynturk Manse	1·59
,,	Probus, Lamellyn	·84	,,	Keith Station	1·67
,,	Wellington, The Avenue	·62	XVIII.	N. Uist, Lochmaddy	2·97
,,	North Cadbury Rectory	1·04	,,	Alvey Manse	1·83
VI.	Clifton, Pembroke Road	·82	,,	Loch Ness, Drumnadrochit.	1·36
,,	Moreton-in-Marsh, Longboro'	1·23	,,	Glencarron Lodge	5·30
,,	Ross, The Graig	·68	,,	Fearn, Lower Pitkerrie	1·51
,,	Shifnal, Hatton Grange	1·21	XIX.	Invershin	1·43
,,	Cheadle, The Heath House.	1·65	,,	Altnaharra	2·17
,,	Coventry, Kingswood	·97	,,	Bettyhill	1·97
VII.	Market Overton	1·25	,,	Watten Station	1·93
,,	Market Rasen	1·00	XX.	Dunmanway, The Rectory..	·95
,,	Bawtry, Hesley Hall	·87	,,	Cork	·84
VIII.	Neston, Hinderton	1·23	,,	Darrynane Abbey	1·62
,,	Southport, Hesketh Park	1·68	,,	Glenam [Clonmel]	1·65
,,	Chatburn, Middlewood	1·30	,,	Ballingarry, Gurteen	1·47
,,	Cartmel, Flookburgh	1·71	,,	Miltown Malbay	1·87
IX.	Langsett Moor, Up. Midhope	1·16	XXI.	Gorey, Courtown House	·82
,,	Scarborough, Scalby	1·07	,,	Moynalty, Westland	1·32
,,	Ingleby Greenhow	·67	,,	Athlone, Twyford	1·28
,,	Mickleton	·52	,,	Mullingar, Belvedere	1·44
X.	Bardon Mill, Beltingham	1·10	XXII.	Woodlawn	1·64
,,	Ewesley, Fallowlees	·90	,,	Westport, Murrisk Abbey..	1·70
,,	Ilderton, Lilburn Cottage..	·38	,,	Collooney, Markree Obsy..	2·09
,,	Keswick, York Bank	1·56	XXIII.	Enniskillen, Portora	2·10
XI.	Llanfrechfa Grange	1·22	,,	Warrenpoint, Summer Hill.	·67
,,	Treherbert, Tyn-y-waun	2·80	,,	Banbridge, Milltown	·94
,,	Carmarthen, The Friary	1·31	,,	Belfast, Springfield	1·45
,,	Castle Malgwyn [Llechryd].	·95	,,	Bushmills, Dundarave	1·74
,,	Plynlimon	3·70	,,	Stewartstown, The Square..	1·43
,,	Tall-y-llyn	1·00	,,	Killybegs	3·27
,,	New Radnor, Ednol	1·19	,,	Horn Head	1·98

METEOROLOGICAL NOTES ON SEPTEMBER, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Opening with a burst of extraordinarily high temp., during which the shade max. twice exceeded the previous record during September, the month's weather continued on the whole fine and warm. The third week was more broken and rainy, but subsequently anti-cyclonic conditions again prevailed, with lower temp. Duration of sunshine 154·1* hours, and R 21·4 hours. Mean temp. 59°·8, or 2°·1 above the average.

CROWBOROUGH.—The first two days were exceedingly warm, the max. temp., 90°·9, on 2nd, being the highest since July 15th, 1881. The month on the whole was pleasant, with considerable brilliant sunshine. Mean temp. 58°·7.

HARTLEY WINTNEY.—Another beautiful month, very hot and dry for the first fortnight. Slight showers in the third week and cooler im the fourth, with E. winds and slight fogs. The great drought still continues with severity.

TORQUAY.—Duration of sunshine 229·0* hours, or 65·1 hours above the average. Mean temp. 60°·4, or 2°·2 above the average. Mean ozone 4·3.

CLIFTON.—Very fine with a large amount of sunshine, and only 5 rain days. The first 10 days were very hot, but from 18th the temp. was moderate, with cool nights and N. and N.E. anti-cyclonic winds.

ROSS.—The three months July, August and September produced only 2·09 in. of R, or 1·78 in. less than the previous smallest amount since 1818.

BOLTON.—Very sunny and dry, most of the R recorded falling during the night. The 2nd, when the mean temp. was 75°·2, was the hottest day ever recorded in Bolton. Duration of sunshine 110·7* hours, or 22·1 hours above the average. Mean temp. 55°·2, or 1° 2 above the average.

SOUTHPORT.—The sunniest September in 16 years, and the least cloudy in 36 years. Mean temp. 57°·0, or 1°·1 above the average, both the daily and monthly range being very great. Duration of sunshine 188·2* hours, or 45·8 hours above the average of 15 years. Duration of R 20·5 hours.

HAVERFORDWEST.—Fine and dry, with bright, warm weather throughout and small R. Duration of sunshine 222·0 hours. Crops good except potatoes.

DOUGLAS.—A beautiful month on the whole, perhaps the finest since these observations began. A week of not unwelcome R, though somewhat cold and stormy, till 18th, was succeeded by brilliantly fine, calm and warm weather. Gardens were superb and harvest well gathered.

DUMFRIES.—Exceptionally dry, the R having been less in 1894 and 1895 only during 47 years. The temp. was also very high being seldom exceeded during the same period. Harvest good, but potato disease was prevalent.

LILLIESLEAF.—R and number of rain days unprecedentedly small. There was most lovely weather for harvest.

CASTLETOWN.—The first two days were very warm, then damp and changeable to 15th. From 15th to the end was dry and sunny, with steady high bar. and light southerly winds. Corn cutting was general after 18th.

MILTOWN MALBAY.—Most of the month was fine, warm and sunny, making amends for the two previous months. Most of the harvest was well secured.

DUBLIN.—A fine, quiet and warm month, with unusual heat at the beginning. A remarkably persistent anti-cyclone from 16th to the 30th coincided with a rainless spell of 14 days, with cold and foggy nights. Mean temp. 57°·1, or 1°·2 above the average. Aurora borealis on the night of 22nd.

BELFAST.—The driest September since 1895, but foggy weather was prevalent especially in the latter days. Crops doing exceedingly well.

OMAGH.—For the first fortnight there was considerable R, thereby endangering the cereal harvest, but from 15th to 30th none whatever fell. It is long indeed since such a continuous and brilliant spell of settled weather occurred and a harvest was gathered under such perfect conditions.

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* Campbell-Stokes.

Climatological Table for the British Empire, April, 1906.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	73·0	12	30·1	15*b*	58·4	36·8	38·5	73	113·8	21·9	·51	9	...
Malta	79·0	16	47·0	1	65·7	53·8	51·6	78	...	44·0	·56	6	4·7
Lagos	93·0	3	72·0	20*c*	88·3	77·9	74·6	71	144·0	62·0	4·00	14	6·1
Cape Town	87·8	29	46·0	7	71·2	54·1	53·3	72	...	...	2·02	7	3·4
Durban, Natal	84·0	16	54·0	7	78·3	61·9	...	...	143·3	...	3·66	14	4·0
Johannesburg (?)	76·4	14	37·0	7	68·6	50·2	44·7	64	143·8	33·8	·83	6	1·7
Mauritius	87·9	10	61·5	15	83·5	68·6	66·7	75	151·0	51·3	·16	4	5·9
Calcutta	104·9	11	71·4	3	97·5	77·3	72·0	65	163·0	67·4	·03	1	5·8
Bombay	91·5	27	72·3	3	88·0	75·5	72·8	76	136·2	64·9	·00	0	0·5
Madras	101·5	20	71·8	12	94·8	78·1	76·4	78	144·5	67·5	·00	0	1·9
Kodaikanal	77·3	17	50·8	1	73·8	54·8	46·5	55	145·0	30·9	2·73	6	3·4
Colombo, Ceylon	92·5	21	74·8	3	90·4	78·2	74·9	77	153·8	72·5	6·72	14	4·4
Hongkong	81·1	9	60·2	1	72·5	66·1	65·6	88	132·2	...	9·79	19	8·9
Melbourne	84·2	9	40·3	20	68·5	52·8	48·4	67	137·9	33·0	1·36	8	7·2
Adelaide	87·0	9	49·7	1	72·8	56·3	51·8	66	143·3	41·8	·88	12	6·3
Coolgardie	101·0	7	39·8	22	81·9	54·3	44·7	43	160·0	32·2	·00	0	2·6
Sydney	88·0	18	51·9	25	75·8	59·6	51·9	64	121·7	41·1	·93	14	4·3
Wellington	65·2	7	39·0	3	59·8	49·9	46·6	73	115·0	35·0	2·54	13	4·7
Auckland	71·0	1	46·5	22	65·1	52·7	52·3	81	130·0	42·0	3·10	17	5·5
Jamaica, Negril Point	86·2	9, 13	63·9	6	84·5	70·0	69·1	72	...	...	6·45	10	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	87·8	13*a*	71·0	4	85·7	74·4	68·1	67	149·6	...	·46	8	3·2
Toronto	69·2	18	27·3	7	52·2	35·8	33·8	69	91·5	18·0	1·61	9	4·9
Fredericton	62·7	30	10·2	3	48·4	27·3	24·0	54	...	...	3·56	11	5·6
Winnipeg	80·8	25	17·5	4	60·3	33·7	...	...	...	...	1·64	5	4·7
Victoria, B.C.	70·7	29	32·6	13	59·8	42·1	...	...	...	...	·46	10	5·5
Dawson	...	...	...	...	...	...	...	...	...	...	...	...	...

a and 17. *b* and 20, 26. *c* and 30.

MALTA.—Mean temp. of air 58°·5, or 1°·1 below the average. Mean hourly velocity of wind 10·2 miles, or 1·0 below average. Mean temp. of sea 62°·1.

Mauritius.—Mean temp. of air 0°·2 above, dew point 2°·1, and R 4·80 in. below averages. Mean hourly velocity of wind 8·6 miles, or 1·9 below average.

MADRAS.—Bright sunshine 239·7 hours.

KODAIKANAL.—Bright sunshine 233 hours.

COLOMBO.—Mean temp. of air 84°·3, or 1°·7 above, of dew point 0°·4 above, and R 4·06 in. below, averages. Mean hourly velocity of wind 7·0 miles.

HONGKONG.—Mean temp. of air 69°·0. Bright sunshine 53·3 hours or 55·8 below the average, mean hourly velocity of wind 17·4 miles, and R 4·23 in. above averages.

Adelaide.—R ·99 in. below average.

Sydney.—Mean temp. of air 3°·0 above, and R 4·61 in. below, averages.

Wellington.—Mean temp. of air 2°·1 below, and R 1·28 in. below, averages.

Auckland.—Mean temp. of air and R very close to average of previous 38 years.

Symons's

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THE CLIMATOLOGICAL ATLAS OF INDIA.

We welcome the largest and most elaborate contribution to the Climatology of the British Empire in the splendid Atlas* by Sir John Eliot, which has just been published.

Volumes 13 and 14 of the *Indian Meteorological Memoirs* gave a summary of the instrumental observations made in India down to 1900, and the data there published in figures are now presented in the more expressive form of maps. Consistency is hard to attain in any large undertaking, and perhaps hardest of all in dealing with observations of the various elements of climate in all parts of a great tropical country, where most of the observers are natives, to whose minds the scientific method is not the most congenial. The Indian Meteorological Service has passed through three stages of evolution, the first prior to 1865, during which such records as existed were the result of local and often spasmodic effort, the second down to 1875, when the importance of the records was realised, and their organization taken in hand by the provincial governments, under different directors, pursuing different methods; and the third since 1875, when the whole system of observations in India was placed under the control of the Imperial Indian Government, and the entire direction confided to one eminent meteorologist. Thus by the close of the nineteenth century there was available for discussion a great amount of meteorological observations, extending over 25 years, obtained under uniform conditions by fairly trained and competently inspected observers. This is the mass of material which is now before us elaborated into 120 plates of beautifully executed coloured maps, and forming a unique storehouse of the climatology of a great unit of tropical land.

The maps are accompanied by a brief explanatory text, which

* *Climatological Atlas of India.* Published by the authority of the Government of India, under the direction of Sir John Eliot, K.C.I.E., F.R.S., late Meteorological Reporter to the Government of India and Director-General of Indian Observatories. Issued by the Indian Meteorological Department, 1906. (Copies of this work may be procured through Messrs. John Bartholomew and Co., The Geographical Institute, Edinburgh. Price, per copy, 27 rupees in India, and 36 shillings in the United Kingdom). Size 18 × 12½. Pp. xxxii. + 120 plates.

adds to their value, and whets the anticipations of the Handbook of the Meteorology of India, which is being compiled as a companion work to the Atlas. There is a mechanical difficulty about the letterpress of this Atlas, which affects the short-sighted reader most unpleasantly: the lines are ten inches long, and in travelling back after following one line to the end, the eye is apt to fall upon the wrong line for the next beginning. Double column printing would have saved a good deal of strain and fatigue to many students.

The first plate in the Atlas is a double page orographical map of India, which brings vividly before the eye the physical contrasts of the country—the low Indo-Gangetic plain in the north, with the huge wall of the Himalaya and the vast plateaus of Tibet and Afghanistan beyond on the northern side, and the moderate elevations of the Deccan filling the peninsula on the southern; and on the east beyond the Bay of Bengal the parallel ranges of south-running mountains in Burma. The main contour lines indicating these all-important features form an unobtrusive background on the maps of meteorological conditions which follow. Then comes a double page map showing the complicated political divisions of India, distinguishing States which remain under native rulers, and thus helping to make clear one of the chief difficulties in securing a uniform system of meteorological observations over a territory which is larger than all Europe outside Russia, and contains more separate units of government. A set of four smaller maps show the rainfall divisions adopted by Mr. Blanford and Sir John Eliot respectively, the medical provinces and the divisions used in the Indian Daily Weather Report.

Pressure and winds are shown in two double page charts of the whole Indian Ocean area for the extreme months January and July. The authority for the winds over the Indian Ocean is not stated, but they are obviously the result of observations and not deduced from the isobars, for in some instances they blow in opposition to the barometric gradients shown; the general scheme of circulation is however perfectly clear, the air flowing from India towards Africa and Australia in January, and towards India from Africa and Australia in July.

The remaining maps refer to the Indian Empire alone. They deal with the various meteorological elements with a degree of detail never hitherto attempted. For pressure and wind there are first of all thirteen plates, giving for each month and for the year the conditions prevailing at 8 a.m., and on a smaller scale at 10 a.m. and 4 p.m. The two latter are particularly interesting, for they show the space as well as the time relations of the great and regular diurnal range of pressure in the tropics, (in some parts of India ·170 in. on the average of a month) and in many places we observe the pressure gradients and wind-directions reversed between forenoon and afternoon. In the annual map for instance at 10 a.m. the isobar of 29·800 inches only occupies a small area on the Indus,

and pressures exceeding 29·875 occur in the south-west, while at 4 p.m. the whole of India is subject to a lower pressure than 29·800, and in the north-west it is below 29·675. A second series of thirteen plates gives for each month and the year the mean pressure for the day, and the diurnal range expressed in two ways, first as actually observed, and second as calculated from the readings reduced to sea level. From the uncertainity of reducing the barometer readings of very lofty stations, none above 3000 feet are utilized, the maps only going as far to the north as Peshawar, Simla, and Darjeeling.

Thirteen plates are next devoted to mean temperatures, dealing with the mean of the day, the mean maximum, and the mean minimum for each month and the year, the data being calculated on a 20 years' average, and reduced to sea level by applying the correction of 1° for every 450 feet of elevation (instead of 1° for 300 feet usually adopted for temperature maps of the world). The average temperature of India being 80°, the colouring of all the maps is so adjusted that temperatures above 80° are indicated in red; below it in green. Mean maximum temperatures of over 100° appear in March, and the area they affect is greatest in May when they prevail over the greater part of India, and they appear for the last time in September.

Another set of thirteen plates is devoted to temperature, showing the diurnal range, the absolute maximum and the absolute minimum for each month and the year. Such data as the two last, which depend on various conditions, cannot be expected to yield perfect results when expressed by lines of equal values, but they are graphic representations all the same. The highest extremes occur in the Indus valley, where minima of 25° or less are recorded near Peshawar in December and January, and maxima of 125° and more about Jacobabad, half-way between Peshawar and the sea, in June and July. The greatest diurnal range (averaging 35° over a month) occurs in September, October and November in the same region of the North-west.

The series of 26 plates devoted to humidity include maps for each month and for the year of the mean relative humidity, and of the mean absolute humidity, expressed as vapour pressure; in each case the daily mean, 8 a.m. mean and 4 p.m. mean for the month being given. These are novel maps full of interesting features. The most striking contrasts are exhibited in the maps for 8 a.m., which show relative humidities of over 90 per cent. for almost every month in Eastern Bengal and Assam, while on the opposite side of India the relative humidity varies with the season from 50 per cent. to less than 30 per cent. There is naturally a much greater diurnal variation of relative than of absolute humidity on account of the great diurnal range of temperature.

A beautiful series of cloud maps for the day and for 8 a.m. and 4 p.m. is another novel feature, and the system of colouring from clear blue for less than one-tenth of the sky clouded to a dark

neutral tint for more than seven-tenths is extremely effective. It is surprising to find that an observation so much affected by the personal equation as is the estimation of cloudiness by eye, yields such satisfactory maps; the general map for the year exhibits a steady diminution of cloudiness from south-east to north-west.

Two sets of maps are devoted to rainfall, the first giving for each month and for the year what is termed the normal rainfall, with the number of days on which the rainfall exceeded ·10 in., and the storm tracks; the second giving the seasonal rainfall and the number of rain days, together with maps of the computed atmospheric pressure at 10,000 feet.

We could wish for more practical details as to the data and methods in the introductory text; it would not have taken much more space to give a general statement as to, *e.g.*, the exposure of thermometers, the height of rain-gauges, the exact period used for calculating averages, and in cases where the averages of different periods at different stations are included a short statement of the probable differences in amount between the averages for the various periods. No doubt all these particulars may be gleaned from the Indian Memoirs, but the Atlas is bound to come into the hands of many who have not access to those volumes. In the case of the rainfall maps, which are based on the records of some 2000 stations, all of which cannot have been in operation during the whole period, the want of information as to the precise conditions implied by the word "normal" is particularly felt, and if it had been possible to give a map showing by dots the distribution of all the stations utilized, it would have been very helpful in the effort to deduce from the maps the exact relation of rainfall to configuration and prevailing winds, the general trend of which is very distinctly shown.

The Atlas taken in conjuction with the Memoirs published already, and the Manual that is to follow, will give the completest account of the climatology of a large country which we possess, and apart from any other publication the Atlas alone is a magnificent acquisition, a very mine of meteorological relationships, for which we cannot be too grateful to the enlightenment of the Indian Government, the patient labour of Sir John Eliot and his assistants, and the technical perfection of the Edinburgh Geographical Institute.

A PLEA FOR THE TEACHING OF METEOROLOGY.

By R. H. Curtis.

The growth of an intelligent interest in meteorology on the part of the general public is manifesting itself in several ways. One very unmistakeable sign of it, which everyone may note, is to be found in the amount of attention which is now paid to the subject of the weather by the daily press, and particularly to the forecasts of the weather published every morning. Not so very long ago there were comparatively few people who troubled themselves to look at these forecasts at all, and the majority of those who did do so regarded

them as little more than guesses,—generally good guesses, perhaps, because they were understood to have been made by people who had given more than ordinary attention to the subject, and presumably had by dint of long practice acquired more skill in reading the signs of coming changes in the weather than ordinary folk possessed; but they were rated as guesses nevertheless, with no more really scientific basis than existed for the predictions of "Old Moore." But to-day the change is great. The forecast is the first thing looked at by thousands of men and women when they open their morning paper at breakfast, or in the train, or on their way to business; and these forecasts are treated with respect as being scientific deductions from observed conditions of the atmosphere, considered in relation to the laws, as far as they are known, by which the movements of the atmosphere are governed. That is the gist of the reply which probably the majority of those who study the forecasts would make if asked to give their opinion about them, although, likely enough, very few could go a step further and give even the most elementary account of the laws themselves. It is, however, a step in advance that the public mind is beginning to accept the fact that there are any "laws" at all in the matter, and to recognize that the daily sequence of weather is not simply fortuitous,—the result of the purest chance. When so much is admitted, a desire on the part of many to get some sort of acquaintance with the laws is sure to follow, and the day when all ordinarily well-educated people will possess at least some elementary ideas of a sound nature about meteorology will thereby be brought considerably nearer.

But signs of the spread of this spirit of enquiry are not wanting even now, and its progress would seem to be more real than possibly many meteorologists suppose. Indeed it may not be amiss to express the hope that some meteorologists may themselves be stirred to acquire a better knowledge of the theoretical side of the subject than they already possess, for it is not an unknown experience to meet with men who make daily observations of the barometer and of temperature, who have a rain gauge, and know all about the rainfall of the district in which they live, and who locally have the reputation of being "meteorologists," but who nevertheless would be sorely puzzled if asked to describe a typical "depression," or to explain what is known as "Buys Ballot's law."

Anyone passing the Meteorological Office in Victoria Street might see at almost any time in the day people stopping at the door, not merely to scan the forecasts exhibited there, but also to study the charts hung by their side, upon which the forecasts are based. Not infrequently when friends are examining these charts together, an interesting discussion, or perhaps explanation, may be heard regarding the relation of the forecast to the conditions indicated by the chart; it is not always that these explanations proceed upon orthodox lines, although frequently they do, but be that as it may they show that the broad principles of the subject are receiving

some attention, and to that extent they are welcome indications of progress to all who are interested in the furtherance of the study of meteorology.

Another and still more promising indication of progress may also be noticed at the door of the Meteorological Office, at a particular part of the day, when the students from a neighbouring training college for schoolmasters going for, or returning from, their daily walk, gather in small groups round the charts, discussing the sequence of changes shown during the past few days, and sketching in their note books the present distribution of pressure and of temperature, and the wind circulation, with a view to subsequent class lectures on the subject. In the direction which this fact indicates lies, we think, the great hope of popularizing the science of meteorology. Hitherto it has been almost entirely omitted from the curricula of our schools, and from the training of the teachers. Smatterings of it have found their way into that olla-podrida of the sciences which under the name of "physiography" has for years been a favourite subject with school teachers in the annual South Kensington Science examinations; but since in addition to meteorology the paper in this subject usually embraces questions in astronomy, geology, vulcanology, chemistry, and possibly other branches of science as well, it is obvious that the modicum of knowledge of each which a student who aspired to grapple with such a "general knowledge" paper would probably acquire, would be insufficient to enable him to teach any of them.

But why should not meteorology now be regarded as a science sufficiently mature to be able to stand upon its own feet, and why should not school teachers be encouraged to take a course of study in meteorology as complete as is now usual in the case of botany or of physiology? Teachers would then have a real acquaintance with the subject, and would be able to impart their knowledge satisfactorily to their pupils; and without doubt both teachers and taught would find the subject at once interesting and useful.

There are teachers who have already made this discovery and have profited by it. Of course in some schools, such as those for young seamen, or those for students of agriculture, meteorology naturally secures a prominent place; but in some "public elementary" schools the subject is also taught so far as first principles are concerned, and the interest of the pupils is further secured by getting them to observe instruments which have been provided as part of the school equipment.

In this country we, as a rule, move slowly, and although the inclusion of meteorology in the ordinary curriculum of school instruction has been advocated for many years, very little has yet been done to bring it about. But the growth of general interest in the subject to which we have drawn attention should we think aid materially in its accomplishment, and with the further development of that interest the time when meteorology shall form a common subject in schools of all grades should not be very distant.

THE RAINFALL OF OCTOBER AND OF 1906.

OCTOBER is normally the wettest month in the year over the greater part of the British Isles, and the month recently ended has exceeded its reputation, for as the mean of 52 well distributed stations the general rainfall of the British Isles has exceeded the average by 42 per cent. The value given for Londonderry in the Table is not supported by other stations, and it seems possible that a mistake has been made in copying the record. Assuming that this is so, the only place where the rainfall of October fell below the average was the extreme north-east of Scotland, where the month was comparatively dry at the stations in Sutherland and Caithness. The excess in the West Highlands was slight, and there were patches in the Lake District, in Wales, Cornwall and Devon, and round the Thames estuary, where the excess did not exceed 25 per cent. London, with only 11 per cent. excess, was one of the driest parts of the country, but the higher land of the Thames valley was nearly the wettest, the rainfall in parts showing an excess of more than 66 per cent. The wettest part of the country, except for a solitary high reading at Aberdeen, was the belt from the Humber to the Severn, where for so many months there has been the greatest drought.

During October there was an exceptionally large number of wet days, but none of excessive wide-spread wetness. Falls of an inch or more in 24 hours occurred only at 25 stations of the 52 under consideration, and at these they were experienced in the track of one or other of the numerous depressions which crossed the country, over 1 inch being measured on the 1st, 2nd, 11th, 18th, 19th, 25th, 26th, 27th, 28th and 30th. The month may thus be classed as generally wet, by whatever standard one cares to employ.

The result of this wet month on the average rainfall of so much of the year as has passed is to wipe out the deficiency of rainfall produced by the dry summer, and up to October 31st the rainfall of the British Isles as a whole was exactly equal to the average. There was very little variation throughout the country, the only large area still uncompensated for the summer drought being the east, south-east, and centre of England, where the deficiences ranged from 5 to 13 per cent. of the average. The extreme rainfall of the first fortnight of November has made it extremely probable that 1906 will have to be classed as a "wet year."

If the relationship between autumn rainfall and the following wheat harvest holds good the prospects for next year are not promising, but on the other hand the replenishment of springs and wells has been going on apace, and the storage of underground water—a subject on which we know far too little—should be satisfactorily advanced for the season.

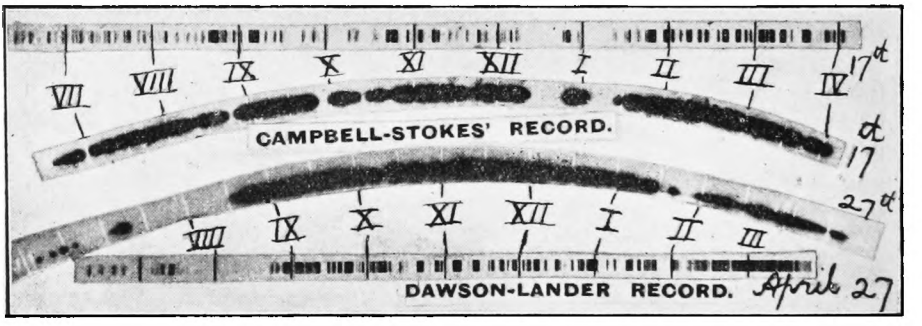
Correspondence.

To the Editor of Symons's Meteorological Magazine.

PHOTOGRAPHIC SUNSHINE RECORDERS.

YOU ask for the opinions of your readers on the relative merits of the photographic and burning sunshine recorders. I have made a careful comparison of these instruments for many years, and my opinion is that the Meteorological Office should have condemned the ferroprussiate paper instead of the recorder. I am convinced that ferroprussiate paper is quite unsuitable. Besides the difficulty of making different batches equally sensitive, it is impossible to keep this sensitiveness for very many months. An observer, who has both recorders, recently showed no less than 200 hours too little sunshine in one year compared with the Campbell-Stokes, and when I asked him the reason, he said it was the paper.

After much experiment I determined that a special kind of collodio-chloride of silver paper was the most suitable, and this has



now been used for some years in my sunshine-recorders all over the world. Gelatino-chloride of silver is useless, as the damp sets up a mouldy growth in the gelatine which soon spoils the paper, but collodion is quite unaffected by damp. If, as you suggest, there is to be a fresh comparison of sunshine-recorders, I trust that this paper will be used. I have modified the aperture of the Jordan pattern recorder to suit this paper, and also to enable, if desired, the same strip of paper to be used for a week. This makes a very simple and inexpensive sunshine-recorder, and is much superior to the Campbell-Stokes. The latter instrument is good enough on a clear bright day with no passing clouds, but if any of your readers at mid-day in summer expose a chart for only *10 seconds* they will find that the record measures nearly *10 minutes*. Therefore, on days with much passing cloud the burns spread and run into each other, and

give a very erroneous record. This is well shown in the photograph. The Campbell-Stokes recorder at 6 a.m. on April 27th gave a correct record, the sun's rays at that early hour not being very hot, but later in the day the record is one of almost continuous sunshine, instead of being a typical April day—showers and sunshine. Some years ago when I pointed out this fault of the Campbell-Stokes to the Meteorological Office, I was told that *uniformity* was more essential than *accuracy*. I admit that uniformity is absolutely essential, but I totally fail to see why it must be *uniformity of error*.

A. LANDER.

Canterbury.

THE GREEN FLASH.

I READ with much pleasure Mr. Thurburn's very thoughtful contribution to this subject in your September issue (pp. 150–1). I have waited until your October number came out in the hope that some correspondent, more competent than myself, would have dealt with the matter. The points brought forward by Mr. Thurburn to account for the absence of the green flash when circumstances appear favourable deserve to be very carefully considered, and I think that they furnish at least a partial solution of the problem.

At every clear sunset the telescope shows us the sun's upper limb fringed with the more refrangible colours—the green and blue. Whether, when the sun's tip disappears, this effect of atmospheric dispersion will give rise to a green flash visible to the naked eye will depend (I think) upon three factors—the brightness, the extent, and the duration of the flash. The duration may be largely affected by the observer's latitude and the extent by the refractive condition of the air. Mr. Thurburn has well pointed out conditions that may affect the brightness.

I append a list of a few recent observations made this year. The letter O denotes an opera glass, power three; the letter B a binocular, power nine.

(1.) *11th June*, 8 h. 25 m. p.m., Leeds, distant land horizon. Sun red. No flash seen. Used O.

(2.) *8th July*, 8 h. 28 m. Locality as in (1). Sun deep yellow. No flash. Used O. Evening beautifully clear.

(3.) *24th July*, 8 h. 0 m. Locality as in (1), but sun set behind a low bank of cloud with a slightly frizzy edge. No flash. Used B.

(4.) *31st July*, 8 h. 0 m. Locality as in (1). A faint, but unmistakable green flash. Evening very clear. Used B. In the morning there had been a thunderstorm.

(5.) *22nd August*, 7 h. 0 m. Pass of Llanberis. Land horizon, formed by a ridge of Snowdon. Perfectly clear. No flash. Used B.

It will be noticed that though aided by a glass, I saw the flash only once in these five attempts.

C. T. WHITMELL.

Invermay, Leeds, 18th October, 1906.

THE duration of the visionary image produced by looking at a bright coloured object depends on several conditions; as, for example, the condition of the atmosphere, the condition and direction of the eye of the observer, the time the object is looked at, etc.

When the eye is in a condition of complete repose, and therefore susceptible, as in the evening twilight or on waking in the morning, it will, if a bright-coloured object is looked at for a moment, produce out of itself a visionary image of this object in the complementary colour. This visionary image will itself last only a second or so, and may well be described as a "flash."

The reason that the phenomenon is so seldom seen is probably due to the fact that special conditions are necessary for its production. The condition of the atmosphere must be suitable; the physical and other features of the place where the sun is rising or setting, and of the district between the observer and the sun must be favourable. The eye of the observer must be susceptible, and it must be properly directed and so on.

It must be remembered that the rising or setting sun makes a notch in the horizon. This is probably the reason why the tips of the segment may appear red, changing to green in the complementary image, while the middle is white or yellowish. It may perhaps be seen better through a telescope, because the telescope brings the sun and the portion of sky near it closer to the observer.

One cannot expect everyone to think alike, and here is an example: The very same phenomenon, which I am convinced is physiological, some others consider to be physical and due to refraction.

I cannot believe that the phenomenon has ever been seen, unless the red edge or red colour or red ray of the rising or setting sun has been first seen above the horizon.

R. C. CANN LIPPINCOTT.

Over Court, Almondsbury, Bristol, 5th November, 1906.

AN AUDIBLE METEOR?

BETWEEN half-past ten and a quarter to eleven on the night of August 7th last I was riding home on my bicycle, when I distinctly heard a faint but clear sound above my head like that made by a rocket as it passes through the air at a considerable distance. On

looking up I saw a shooting-star still on the move, but leaving a streak of light behind it. It is difficult to describe, but when I first looked up there was a streak of light which got increasingly longer from one end until after quite an appreciable time the moving end suddenly stopped. The streak seemed to remain still for a while, and then quite gradually ceased to exist, the light diminishing from both ends and then going out.

I should like to know whether you think the sound heard had anything to do with what I saw, as the combination of the two things struck me as being very odd. I may add that the night was a fine one and very still.

E. HUNTLEY.

Friars Street, Sudbury, Suffolk, September 13th, 1906.

FIREBALL.

On Sunday, 13th May, 1906, I was watching the heavy rain, hearing the rattling of the large hailstones and listening to the near and deafening noise of the rumbling thunder, when suddenly I thought "How strange, I have not seen one flash of lightning!" I leaned forward to have a wider range through the open window, when I saw a large, dark egg-shaped ball swiftly falling straight down from the sky in the open space between two elm trees on the lawn and a fir-tree. When the ball came to about the height of the latter, it suddenly collapsed and sparks of fire flew about in all directions like a magnificent firework. I was so startled that I fell back, but afterwards looked out to see if there was any impression made on the ground. I could see nothing, sheep, lambs, the cob and pony, were grazing, but not near the spot. Two miles away glass was broken and grass burned during the storm.

When the ball split, a solid lump of rather *light* looking fire (like the colour of a blaze) issued forth, at first more from the bottom than the sides, and this emitted thousands of red-hot (bright deep red) sparks which flew in all directions, taking a circular shape. It all happened in the wink of an eye. It seemed to my sight the size of a goose's egg, but my naturally long sight is defective from age. The servant describes it as "a large globe." She is near-sighted.

S. E. L. G.

East Woolsery, Morchard Bishop.

[There is a great deal of uncertainty in the records of all sudden appearances of short duration, and it does not follow that the impression produced on the eye by a sudden light corresponds to the real phenomenon. The above description, however, appears worthy of being placed on record.—Ed., *S.M.M.*]

STORM CLOUDS ON NOVEMBER 3rd.

POSSIBLY readers may have studied the remarkable cloud forms which brought the heavy rain of November 3rd.

At Ide Hill, near Sevenoaks, the forenoon was mild and sunny, and the woodland foliage, having at length after several weeks succumbed to the chill embrace and waning light of autumn, was all aglow in shades of gold, orange, russet and carmine, with warm and gentle sunshine. But in accordance with the inclemency of late autumn, this fitful gleam of sunshine proved of short duration, and in less than three hours the air was becoming harsh and cold, whilst dark lowering cumulus clouds of bold and mountainous form, with patches of glaucous sky interspersed, were moving rapidly from the southward, causing the coloured landscape to assume an expression at once sombre, impressive and beautiful.

About 3 p.m. heavy rain, accompanied by occasional thunder and lightning of slight intensity, commenced to fall, and continued till late in the evening. I may add that as I was walking after dark in the heavy rainstorm from Ide Hill to Sevenoaks, pheasants in the woods were calling vehemently.

The electric potential gradient during the day over the south of England must have been very steep, and we may presume that but for the absence of a dry stratum of air between the thunderclouds and the ground, equilibrium would have restored itself by violent disruptive discharges, instead of by a nearly quiet flow of electricity along the moist conducting paths.

The weather chart for 8 a.m. on November 3rd shows a distribution of pressure favourable to thunderstorms.

L. C. W. BONACINA.

November 4th, 1906.

HEAVY RAINFALLS.

THE rainfall at Sunderland for the 24 hours ending at 8 a.m. on October 19th amounted to 2·13 inches. This is the second time this year that the amount for 24 hours exceeded 2 in. (see this Magazine, p. 92). The same occurred in 1900. From September 25th, 1888, inclusive, this is the eighth time a fall has exceeded 2 inches, but it is remarkable that between September 19th, 1859, when over 2 inches fell, and that date, there was no such fall.

T. W. BACKHOUSE.

West Hendon House, Sunderland, 22nd October, 1906.

RAINFALL TERMINOLOGY.

RE term for a rainy period. Why not use "Drench"? Is it not quite as appropriate as "Drought"?

CH. P. HOOKER.

Dollarward House, Cirencester.

THE RAINFALL OF BEIRA.

THE Companhia de Moçambique has forwarded to us the readings of rainfall taken at Beira, from August, 1901, to July, 1906. We quote below the four complete years of this record, which is remarkable for the extreme variability of the monthly values. It would appear that the five months from November to March constitute the wet season, the seven months from April to October being dry. The two parts of the year divided in this way give the following totals of rainfall.

	1901-2.	1902-3.	1903-4.	1904-5.	1905-6.	Average.
November to March..	46·30	25·23	55·27	43·12	31·77	40·34
April to October.....	6·77	12·52	17·68	3·68	No obs.	10·16

It is probable in view of the extreme variability which this table shows that if the record were longer it might be necessary to alter the limits of the wet and dry seasons. We are not informed whether this record was taken from the great rain gauge, a photograph of which was given in this Magazine, Vol. **40**, p. 204, but presume that it was so.

Rainfall at Beira, Portuguese East Africa, lat. 19°50′ *S., long.* 34°50′ *E.* 50 *feet above the sea.*

	1902.	1903.	1904.	1905.
January	8·65	10·47	18·01	3·34
February	10·46	3·35	10·30	11·39
March	18·70	5·06	13·22	15·93
April	·59	2·76	8·74	·29
May	2·25	2·75	3·57	·61
June	·29	·29	·19	·20
July	·42	·10	1·31	·96
August	·41	5·11	·74	1·14
September.....	·51	1·00	·93	·48
October	2·30	·50	2·21	...
November	4·34	9·58	2·12	3·96
December	2·00	4·18	10·33	9·40
Total	50·92	45·15	71·67	47·70

METEOROLOGICAL NEWS.

LECTURES ON METEOROLOGICAL SUBJECTS, under the scheme of the Royal Meteorological Society, will be given by the Society's Lecturer, Mr. W. Marriott, on November 14th at the College, Eastbourne; on the 24th at St. Felix School, Southwold; on the 28th at Christ's College, Brecon, and on December 18th at the Literary and Scientific Institution, Highgate.

REVIEWS.

Studies on the Diurnal Periods in the Lower Strata of the Atmosphere. (*Reprints from the Monthly Weather Review*, 1905.) By FRANK HAGAR BIGELOW, M.A., L.H.D., Professor of Meteorology. Washington, 1905. Size $11\frac{1}{2} \times 9\frac{1}{2}$. Pp. 52.

PROFESSOR BIGELOW here embodies the results of a discussion of data derived from balloon and kite ascents made at Berlin, Trappes, Hald and Blue Hill, during the past ten years, regarding the periodic diurnal variations occurring in those strata of the atmosphere lying between sea-level and an altitude of two miles, in temperature, pressure, vapour tension, electric potential, co-efficient of dissipation of electric charges, and action of the magnetic force. The periodic daily temperature variations occurring in the free atmosphere, which are different from, and often inverted with regard to, those at the surface, the diurnal, semi-diurnal, and tri-diurnal temperature waves, are held to explain the periodic daily pressure changes, the temperature waves affecting the density, and therefore the pressure of the air in the different strata, rather than evoking dynamic pressure waves as suggested by Lord Kelvin. The fact that the atoms and molecules of the atmospheric gases undergo partial "ionization" when exposed to certain conditions is brought forward to elucidate the problems of the diurnal periods of the terrestrial magnetic force and electric potential gradients. The free electric charges or "ions," the products of temporarily ruptured molecules of aqueous vapour or atoms of the elementary gases oxygen and nitrogen, by moving from one level to another, occasion the hourly variations of the magnetic field; by shifting from one hemisphere to another produce the daily variations of the field, auroral displays, Earth-currents, and by acting in conjunction with the diurnal temperature variations in the free air, originate the changes in the electric potential gradient.

The sun is to be regarded as a variable star. The variability in the intensity of solar activity as registered by the sun's spots, but more actively by its atmospheric hydrogen prominences, is shown from curves obtained by comparing the variations in solar activity with those in the activity of the Earth's magnetic field, and by computing the mean annual pressures and temperatures for the years 1872—1900, at several hundred stations scattered over the globe, to have a counterpart in the variability of the Earth's magnetic field and in changes of temperature and pressure in the Earth's atmosphere, through the electro-magnetic radiation of the sun; it is further demonstrated that while increased solar activity manifests itself directly in the tropical regions where the sun's rays are most powerful, by increased temperature, in temperate latitudes it is associated, or apt to be associated, with lowered temperature due to the augmented flow equator-wards of cold polar winds. The variations in the amount of solar energy received by the Earth, moreover, impose a complex modification on the circulation of the Earth's atmosphere, *i.e.*, in the distribution of its pressure. L.C.W.B.

The Rains of the Nile Basin in 1905, by CAPTAIN H. G. LYONS, *Director-General Survey Department.* Cairo: 1906. Size 11 × 8. Pp. 40. Maps and diagrams.

CAPTAIN LYONS has greatly extended the rainfall observations in the Egyptian Sudan, and correlated them with observations in Abyssinia, Eritrea, and British East Africa. In this report he points out that the rainfall over the Nile area is regulated by the sun's annual motion north and south of the equator, the region of heaviest precipitation shifting its position according to the time of year so as always to be approximately beneath the vertical sun, within the central low pressure system. Thus at the equinoxes the rainfall is heaviest in the equatorial lake regions, where the White Nile has its source, whilst in June, July and August, it is heaviest in northern Sudan and the Abyssinian tableland, in December and January the rains are south of the equator. That part of the Nile basin situated between 18° and 30° N. is practically rainless, but the delta which lies north of 30° N. comes within the influence of the Mediterranean winter rains. In 1905 the number of stations to afford rainfall measurements was seventy-eight, against forty-six in 1904, and the number of stations which merely record rain days was forty-four. The rainfall during 1905 was generally deficient over the Nile Basin. Over the delta the winter rainfall was fairly large as compared with that of 1904, the total depth at Alexandria during the six months January—March, and October—December, amounting to 10·6 inches; the importance of this winter rain is in connection with the barley crop. Over the Blue Nile plains the summer rains were abundant, but on the Abyssinian tableland, where, during the months of July and August the total amount of precipitation normally amounts to 27·5 inches, they were greatly deficient. The basins of the White Nile, Sobat and Bahr-el-Jebel, also experienced a great deficiency of rainfall.

The Nile flood* was only ·65 of an average flood, the average being based upon 163 years of reliable records. During the past ten years the value of the "flood" has slightly exceeded the average in 1896 and 1898, but has been below it in the other eight years. From the few existing records of the water-level of the Bahr-el-Jebel and of the rainfall over the basin of that river it has been found that the amount of rain which falls over a certain part of the basin has a special effect upon the water-level, and this fact should therefore be taken into consideration in the formulation of any project for increasing the volume of water which enters the White Nile.

Captain Lyons finds confirmation in 1905 of the relation between the rainfall of Abyssinia and the atmospheric pressure over north-eastern Africa, which he previously pointed out, viz.: that in years of scanty flood pressure is nearly always excessive, and *vice-versâ*.

L. C. W. B.

* Reckoned upon the volume of water passing Aswan between July 1st and October 31st.

TEMPERATURE FOR OCTOBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [-E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32° Shade.	Grass.
		° ′	° ′							
Camden Square	*London*	51 32	0 8	111	71·0	1	35·4	26	0	0
Tenterden	*Kent*	51 4	*0 41	190	72·0	11	34·0	15	0	4
West Dean	*Hampshire*	51 3	1 38	137	69·0	1	30·0	26	2	6
Hartley Wintney	,,	51 18	0 53	222	69·0	1, 17	30·0	26	1	6
Hitchin	*Hertfordshire*	51 57	0 17	238	69·0	9	33·0	26	0	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	69·0	1	31·0	26	1	6
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	73·0	11	35·0	26	0	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	64·6	3	27·5	31	3	8
Torquay (Cary Green)	*Devon*	50 28	3 32	12	65·9	3	35·1	31	0	1
Polapit Tamar [Launceston]	,,	50 40	4 22	315	64·0	3	31·2	20	1	5
Bath	*Somerset*	51 23	2 21	67	68·0	1	33·5	20	0	0
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	69·0	1	37·0	13	0	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	63·0	1	26·0	14	7	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	66·0	3	27·0	19	3	...
Boston	*Lincolnshire*	52 58	0 1	25	66·0	11	33·0	20	0	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	68·9	10	32·9	26	0	9
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	70·0	1	34·0	19	0	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	65·0	1, 5	32·2	14	0	4
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	71·0	10	35·0	29	0	6
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	63·7	11	28·5	14	2	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	62·6	1	28·8	20	1	5
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	68·0	5	27·0	9	4	...
Llandudno	*Carnarvon*	53 20	3 50	72	66·0	1	35·0	30	0	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	63·0	10	28·0	14	3	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	64·0	2	26·0	28	5	11
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	64·1	5	31·5	30	2	3
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	63·0	2, 3	25·0	29	2	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	63·0	7	26·0	14	2	15
Tighnabruaich	*Argyll*	55 55	5 14	50	58·0	7	30·0	30	2	3
Mull (Quinish)	,,	56 36	6 13	35	57·0	22	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	64·9	7	29·8	30	2	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	65·0	5, 6	25·0	29	6	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	64·0	7	28·0	30	3	...
Castletown	*Caithness*	58 35	3 23	100	63·0	7	23·0	30	5	5
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	69·5	2	32·5	19	0	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	65·0	8	28·0	20	4	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	64·0	7	30·0	18†	4	..
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	65·1	6	32·9	20	0	3
Ballinasloe	*Galway*	53 20	8 15	160	69·0	21	23·0	19, 20	12	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	61·0	1, 10	29·0	27	2	8
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	63·0	10	27·0	19	6	8

† and 19, 31.

RAINFALL FOR OCTOBER, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.	Mean Annual 1870-1899.	STATION.
in.	in.	in.		in.	Date.		in.	in.	in.		in.	
2·85	3·15	+ ·30	111	·47	29	17	20·59	17·86	—2·73	87	25·16	Camden Square
3·60	4·52	+ ·92	126	1·16	30	18	22·40	19·55	—2·85	87	28·36	Tenterden
3·53	5·81	+2·28	165	·89	18	25	23·94	24·00	+ ·06	100	29·93	West Dean
3·08	5·11	+2·03	166	1·14	18	21	21·52	20·30	—1·22	94	27·10	Hartley Wintney
2·72	4·19	+1·47	154	·83	18	21	20·05	19·21	— ·84	96	24·66	Hitchin
2·89	3·94	+1·05	136	·78	2	19	21·85	19·64	—2·21	90	26·75	Addington
2·66	4·52	+1·86	170	·94	29	17	20·78	20·82	+ ·04	100	25·39	Westley
2·98	3·17	+ ·19	106	1·01	2	18	20·56	21·98	+1·42	107	25·40	Brundall
4·33	6·86	+2·53	158	1·09	1	26	30·05	31·94	+1·89	106	39·00	Winterbourne Stpltn
4·09	4·52	+ ·43	111	·72	9	22	27·83	23·52	—4·31	84	35·00	Torquay
4·97	5·72	+ ·75	115	·92	1	26	30·17	31·38	+1·21	104	38·85	Polapit Tamar
3·22	4·91	+1·69	152	·83	2	25	24·93	22·37	—2·56	90	30·75	Bath
3·10	5·35	+2·25	173	1·09	2	27	24·38	21·58	—2·80	89	29·85	Stroud
3·99	5·46	+1·47	137	·71	17	27	26·94	23·37	—3·57	87	33·04	Woolstaston
2·55	4·34	+1·79	170	·72	18	22	20·28	19·16	—1·12	94	24·50	Bromsgrove
2·62	4·13	+1·51	158	1·15	2	21	19·37	18·56	— ·81	96	23·30	Boston
2·77	5·01	+2·24	181	·93	18	23	20·58	18·18	—2·40	88	24·70	Hodsock Priory
2·77	5·05	+2·28	182	·86	2	25	21·62	19·13	—2·49	88	26·18	Derby
4·72	7·36	+2·64	156	1·54	28	29	34·33	40·90	+6·57	119	42·43	Bolton
3·18	4·94	+1·76	155	·67	18	24	22·54	21·88	— ·66	97	26·96	Ribston Hall
6·55	10·63	+4·08	162	1·66	28	29	48·55	54·63	+6·08	113	60·96	Arncliffe Vic.
3·26	5·04	+1·78	155	1·36	18	20	22·21	19·87	—2·34	89	27·02	Hull
2·94	4·65	+1·71	158	1·64	18	23	22·70	23·03	+ ·33	101	27·99	Newcastle
13·35	15·87	+2·52	119	2·72	27	28	104·07	105·06	+ ·99	101	132·68	Seathwaite
4·81	7·67	+2·86	159	1·70	1	27	34·12	36·89	+2·77	108	42·81	Cardiff
5·63	8·79	+3·16	156	1·57	2	28	37·25	41·33	+4·08	111	47·88	Haverfordwest
5·58	6·77	+1·19	121	·90	17	27	36·24	39·28	+3·04	108	45·41	Gogerddan
4·08	5·23	+1·15	128	·92	17	26	24·65	26·62	+1·97	108	30·98	Llandudno
4·39	5·54	+1·15	126	1·34	26	20	34·25	37·79	+3·54	110	43·43	Cargen
3·24	5·65	+2·41	174	·75	4	26	26·57	28·74	+2·17	108	33·04	Riddell House
...	6·11	...	...	1·44	19	23	...	26·46	...	...	...	Edinburgh
4·97	7·52	+2·55	151	1·62	11	23	35·16	33·64	—1·52	96	44·85	Colmonell
3·36	5·33	+1·97	159	·80	11, 26	26	28·79	32·27	+3·48	112	35·80	Glasgow
5·72	8·92	+3·20	156	1·74	26	25	45·36	54·43	+9·07	120	57·90	Tighnabruaich
6·09	7·47	+1·38	123	·75	29	28	44·62	42·74	—1·88	96	57·53	Quinish
2·71	3·75	+1·04	138	·85	11	23	23·46	21·20	—2·25	90	28·95	Dundee
4·05	5·34	+1·29	132	...	...	...	28·98	28·32	— ·66	98	36·07	Braemar
3·18	6·23	+3·05	196	1·48	19	22	26·15	27·13	+ ·98	104	33·01	Aberdeen
2·85	4·07	+1·22	143	1·95	19	20	24·19	24·74	+ ·55	102	29·37	Cawdor
5·54	8·04	+2·50	145	·97	26	17	43·35	46·81	+3·46	108	56·00	Invergarry
9·98	10·52	+ ·54	105	1·37	27	28	67·67	73·20	+5·53	108	86·50	Bendamph
3·32	2·44	— ·88	73	1·05	19	12	24·95	29·53	+4·58	118	31·60	Dunrobin Castle
...	2·84	...	...	·59	19	25	...	28·50	...	..	...	Castletown
6·05	7·61	+1·56	126	·74	26	30	45·62	38·30	—7·32	84	58·11	Killarney
4·00	6·10	+2·10	152	1·11	11	29	31·08	28·76	—2·32	93	39·30	Waterford
3·12	5·43	+2·31	174	·67	11	26	26·91	31·63	+4·72	118	33·47	Hurdlestown
3·48	4·63	+1·15	133	·81	26	21	27·84	23·80	—4·04	85	34·44	Carlow
3·08	3·32	+ ·24	108	·50	11	22	22·76	19·44	—3·32	85	27·75	Dublin
3·45	4·69	+1·24	136	·68	27	25	29·81	32·05	+2·24	108	37·04	Ballinasloe
7·93	9·46	+1·53	119	1·60	25	21	62·99	59·62	—3·37	95	80·23	Kylemore House
5·04	6·43	+1·39	128	1·46	27	25	39·06	41·96	+2·90	107	50·50	Enniscoe
3·82	5·13	+1·31	134	·94	11	25	31·03	27·85	—3·18	90	38·61	Seaforde
4·45	3·39?	...	...	·41?	27	26	32·70	33·85?	...	...	41·20	Londonderry
3·72	5·65	+1·93	152	1·15	27	30	30·55	35·26	+4·71	115	37·85	Omagh

SUPPLEMENTARY RAINFALL, OCTOBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	5·06	XI.	Rhayader, Tyrmynydd	8·85
,,	Ramsgate, West Cliff Villas	1·57	,,	Lake Vyrnwy	7·76
,,	Hailsham	4·97	,,	Llangyhanfal, Plâs Draw	5·97
,,	Crowborough, Uckfield Lodge	5·86	,,	Criccieth, Talarvor	5·97
,,	Osborne, Newbarn Cottage.	5·30	,,	Llanberis, Pen-y-pass	13·04
,,	Emsworth, Redlands	5·05	,,	Lligwy	6·44
,,	Alton, Ashdell	5·73	,,	Douglas, Woodville	4·80
,,	Newbury, Welford Park	5·48	XII.	Stoneykirk, Ardwell House	5·90
III.	Harrow Weald, Hill House.	3·82	,,	Dalry, The Old Garroch	8·80
,,	Oxford, Magdalen College..	3·92	,,	Langholm, Drove Road	7·19
,,	Bloxham Grove	4·89	,,	Moniaive, Maxwelton House	8·22
,,	Pitsford, Sedgebrook	4·13	XIII.	N. Esk Reservoir [Penicuick]	8·30
,,	Huntingdon, Brampton	3·41	XIV.	Maybole, Knockdon Farm..	5·80
,,	Wisbech, Bank House	2·94	XV.	Campbeltown, Witchburn	7·04
IV.	Southend Water Works	3·82	,,	Inveraray, Newtown	10·18
,,	Colchester, Lexden	3·46	,,	Ballachulish House	10·39
,,	Newport, The Vicarage	3·76	,,	Islay, Eallabus	5·74
,,	Rendlesham	3·06	XVI.	Dollar Academy	6·73
,,	Swaffham	4·58	,,	Loch Leven Sluice	5·33
,,	Blakeney	1·90	,,	Balquhidder, Stronvar	...
V.	Bishops Cannings	5·47	,,	Perth, Pitcullen House	3·39
,,	Ashburton, Druid House	8·20	,,	Coupar Angus Station	3·46
,,	Okehampton, Oaklands	6·19	,,	Blair Atholl	5·52
,,	Hartland Abbey	5·12	,,	Montrose, Sunnyside Asylum	4·03
,,	Lynmouth, Rock House	6·66	XVII.	Alford, Lynturk Manse	5·21
,,	Probus, Lamellyn	5·11	,,	Keith Station	4·76
,,	Wellington, The Avenue	4·32	XVIII.	N. Uist, Lochmaddy	4·49
,,	North Cadbury Rectory	4·47	,,	Alvey Manse	4·98
VI.	Clifton, Pembroke Road	5·88	,,	Loch Ness, Drumnadrochit.	6·27
,,	Moreton-in-Marsh, Longboro'	5·20	,,	Glencarron Lodge	8·78
,,	Ross, The Graig	4·19	,,	Fearn, Lower Pitkerrie	2·55
,,	Shifnal, Hatton Grange	4·74	XIX.	Invershin	2·72
,,	Cheadle, The Heath House.	5·57	,,	Altnaharra	3·27
,,	Coventry, Kingswood	5·00	,,	Bettyhill	2·88
VII.	Market Overton	4·44	,,	Watten Station	2·48
,,	Market Rasen	4·36	XX.	Dunmanway, The Rectory..	7·25
,,	Bawtry, Hesley Hall	4·37	,,	Cork	4·14
VIII.	Neston, Hinderton	4·35	,,	Darrynane Abbey	6·25
,,	Southport, Hesketh Park	5·62	,,	Glenam [Clonmel]	6·22
,,	Chatburn, Middlewood	6·85	,,	Ballingarry, Gurteen	4·88
,,	Cartmel, Flookburgh	6·42	,,	Miltown Malbay	7·55
IX.	Langsett Moor, Up. Midhope	7·68	XXI.	Gorey, Courtown House	4·78
,,	Scarborough, Scalby	4·85	,,	Moynalty, Westland	5·02
,,	Ingleby Greenhow	6·34	,,	Athlone, Twyford	5·84
,,	Mickleton	4·38	,,	Mullingar, Belvedere	5·89
X.	Bardon Mill, Beltingham	4·87	XXII.	Woodlawn	6·80
,,	Ewesley, Fallowlees	7·10	,,	Westport, Murrisk Abbey..	5·86
,,	Ilderton, Lilburn Cottage..	6·44	,,	Collooney, Markree Obsy..	4·78
,,	Keswick, York Bank	8·07	XXIII.	Enniskillen, Portora	4·91
XI.	Llanfrechfa Grange	7·73	,,	Warrenpoint, Summer Hill.	4·00
,,	Treherbert, Tyn-y-waun	13·35	,,	Banbridge, Milltown	5·22
,,	Carmarthen, The Friary	8·93	,,	Belfast, Springfield	4·79
,,	Castle Malgwyn [Llechryd].	8·84	,,	Bushmills, Dundarave	3·70
,,	Plynlimon	11·05	,,	Stewartstown, The Square..	4·64
,,	Tall-y-llyn	4·80	,,	Killybegs	6·51
,,	New Radnor, Ednol	6·12	,,	Horn Head	4·64

METEOROLOGICAL NOTES ON OCTOBER, 1906.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

London, Camden Square.—A cloudy, damp and extremely mild month, with few very fine but few very wet days. The mean temp. 54°·2 was 4°·4 above the average, and the highest in October during 49 years, except 55°·3 in 1861. Duration of sunshine 56·2* hours, and of R 49·6 hours.

Crowborough.—A pleasant, genial and unusually warm month. The mean temp. was 52°·9, or 8°·5 above that of October, 1905. R 1·62 in. above the average of 35 years. Prevailing winds S. and W.

Hartley Wintney.—Storms of wind and much R, chiefly at night. The days were warm and beautiful, and absence of frost enabled oaks in the neighbourhood to retain their leaf. Ozone on 13 days; mean 3·2.

Wellington.—Almost persistently rainy, R being recorded on 26 days, with a total an inch above the average. It was generally very mild, with the exception of the last three days.

Ross.—A month with frequent R, but sunny intervals. Mean temp. 3°·1 above the average of 40 years, the mean max., 58°·3, having been exceeded twice only since 1859. No sharp frost, and only slight damage done to tender plants.

Worksop, Hodsock Priory.—Very mild; the wettest October since 1885, and the wettest month since December, 1901.

Bolton.—The warmest October on record since 1886, the mean temp. being 49°·4, or 2°·5 above the average of 20 years. The duration of sunshine was only 31·7* hours, or 25·7 hours below the average; 12 sunless days.

Southport.—Exceptionally mild, wet and sunless, with a preponderance of S.E. and S. winds, and low bar. pressure. Mean temp. 51°·7, or 2°·8 above the average. Duration of sunshine 74·5* hours, being 20·0 hours below the average, and duration of R 92·1 hours. Underground water was at a low level until the middle of the month, but subsequently rose considerably.

Haverfordwest.—Wet and stormy, most of the R falling at night. Generally mild. Agricultural operations were well advanced. Duration of sunshine 97·7* hours.

Lilliesleaf.—Remarkable for the great quantity of R, more than making up for the shortage of September. The weather was mild and good for the garden and for turnips.

Mull.—A very wet month. Violent gales from S.W. on 17th and 26th, which subsided as suddenly as they rose, but otherwise calm.

Coupar Angus.—The R was ·89 in. above the average of 26 years, and the number of rain days was the greatest in that period. The mean temp., 47°·6, had not been so high since 1886. Pasture was never more abundant so late in the season.

Altnaharra.—Exceptionally favourable weather throughout, with keen frost at night towards the end. No S below the 1000 foot line, except a shower or two, and above 2000 feet it did not remain long at any time.

Castletown—Generally fine and settled, One of the finest harvest times for many years, corn crops being practically all stacked by 25th. Strong gale from 3 to 7 p.m. on 19th, beginning and ending suddenly.

Cork. The mean temp. was normal, that of the first half being 52°·6 and of the latter half 45°·4. R ·84 in. above the average. Prevailing winds S. and N.W.

Dublin.—Mild but rainy. Mean temp. 51°·2, or 1°·8 above the average, but from 17th to 20th and from 27th to the close, sharp cold snaps occurred.

Belfast.—A really disappointing month, and of no value to the land. The R was almost an inch above the average.

Omagh.—A saturating month, with R on every day but one, and occasionally very heavy. Temp. was most irregular, day and night being abnormally high and low in rapid succession.

* Campbell-Stokes.

Climatological Table for the British Empire, May, 1906.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	78·9	8	32·1	1	63·8	45·9	47·3	78	123·9	27·8	1·09	14	7·5
Malta	86·8	31	49·6	4	72·8	57·6	54·5	73	...	42·9	·36	4	3·1
Lagos	...	...	...	...	...	...	...	...	...	...	..	...	...
Cape Town	75·1	9	44·8	27	65·1	52·9	50·9	72	...	...	3·65	10	5·2
Durban, Natal	83·7	5	50·8	31	76·1	59·0	...	...	136·3	...	1·76	9	2·7
Johannesburg	72·8	14	34·2	19	66·2	47·3	42·5	66	139·0	31·6	·11	2	1·1
Mauritius	84·0	5	57·4	13	79·2	66·8	64·2	76	149·4	47·6	3·92	20	7·1
Calcutta	105·8	2	70·6	10	97·3	78·9	76·1	72	162·1	68·2	3·98	6	3·1
Bombay	93·0	30	76·9	1	91·5	80·9	76·4	73	139·2	71·8	·00	0	3·0
Madras	111·5	27	77·2	6	100·8	83·0	76·5	71	149·6	74·6	·00	0	2·9
Kodaikanal	76·1	25	52·7	21	71·1	56·4	51·8	67	142·2	39·3	4·10	16	4·4
Colombo, Ceylon	89·2	sev.	72·0	20	87·9	78·4	76·4	84	153·6	70·4	6·96	25	7·0
Hongkong	89·4	21	66·7	2	80·6	73·2	71·8	86	147·8	...	11·58	16	7·9
Melbourne	69·1	9	37·5	22	60·7	48·3	47·8	80	125·5	30·5	1·77	11	7·3
Adelaide	82·3	10	46·0	25	68·0	52·0	50·8	74	138·0	38·7	2·12	12	5·9
Coolgardie	84·4	16	38·1	11	71·9	48·7	44·0	56	142·0	33·2	1·49	4	3·6
Sydney	79·9	6	48·0	31	67·1	54·0	50·6	78	110·6	37·0	7·32	26	5·2
Wellington	64·5	3	39·8	6	56·7	47·6	46·8	80	105·0	35·0	6·18	17	7·2
Auckland	66·0	3, 4	41·0	5	60·0	50·8	49·6	81	118·0	35·0	4·60	17	6·0
Jamaica, Negril Point	88·5	8	69·3	2	85·6	73·6	73·6	79	...	...	7·85	12	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	88·0	5, 11	72·2	23	85·6	75·0	70·9	72	148·2	...	5·48	20	4·4
Toronto	86·0	18	30·5	11	...	...	41·9	67	...	...	2·51	11	6·0
Fredericton	77·3	19	27·5	12	...	...	35·3	54	...	...	3·46	12	6·0
Winnipeg	84·3	11	17·8	6	...	...	...	...	...	...	2·97	9	...
Victoria, B.C.	72·4	8	38·2	5	...	...	...	...	...	...	1·81	9	7·0
Dawson	...	...	...	...	...	...	...	...	...	...	...	...	...

MALTA.—Mean temp. of air 63°·6, or 0°·4 above the average. Mean hourly velocity of wind 9·4 miles, or 0·5 below average. Mean temp. of sea 64°·2.

Mauritius.—Mean temp. of air equal to, dew point 1°·1 below, and R ·23 in. above, averages. Mean hourly velocity of wind 10·3 miles, or 0·7 above average.

MADRAS.—Bright sunshine 214·1 hours.

KODAIKANAL.—Bright sunshine 238 hours.

COLOMBO.—Mean temp. of air 82°·7, or 0°·3 above, of dew point 1°·1 above, and R 4·98 in. below, averages. Mean hourly velocity of wind 9·3 miles.

HONGKONG.—Mean temp. of air 76°·5. Bright sunshine 137·6 hours. Mean hourly velocity of wind 13·3 miles.

Adelaide.—Mean temp. 2°·4 above, R ·64 in. below, averages.

Sydney.—Mean temp. of air 2°·1 above, and R 2·06 in. above, averages.

Wellington.—Mean temp. of air 0°·7 below average.

Auckland.—Mean temp. of air 1°·0 above, R rather over half an inch above average of previous 38 years.

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FALL OF A WIRELESS TELEGRAPHY TOWER IN A GALE.

By W. A. S. Douglas, M.A.

The first Wireless Telegraphy Station to be erected in Scotland was completed early in 1906 at Machrihanish, a small village, well known to golfers, on the shores of the Atlantic, some eight miles north of the Mull of Kintyre and five miles west of Campbeltown. This tower was blown down on the afternoon of the fifth of December, during a heavy gale from the north-west, and I send a description based on my familiarity with the locality and on reports in local newspapers. The authorities in charge have given no information on the subject.

In order to understand the nature of the catastrophe it is necessary first to consider the tower and its mode of construction. The station was built by the National Electric Signalling Company of Washington, U.S.A., in order to exploit a discovery of Professor Fessenden regarding wireless telegraphy. By his method, Professor Fessenden claims that messages can be sent right across the Atlantic, and the tower was designed for the purpose of communicating with an American station near Boston. In order to insure perfect similarity in the two stations, all the machinery and materials for the station in this country were shipped from America and put together at Machrihanish. The buildings, as shown in the accompanying sketch (fig. 1), consist of a power house, with large engines and dynamos, a receiving and transmitting room, and, lastly, the lofty stalk or tower which has now been destroyed by the wind.

The height of the tower was 420 feet, and the whole structure was built of hollow steel tubes of the uniform diameter of three feet. Each tube was eight feet in length, but as there was three feet of overlap for rivetting purposes as many as eighty-four tubes were used in the construction of the tower. An iron ladder ran up the inside to the top and at each hundred feet there was an outside balcony. The foundation was the most novel feature in the whole construction. The base of the erection, as shown in fig. 3, was a large square of concrete, on the top of which insulators were placed, and then another layer of concrete, in which was embedded a pivot,

and upon this the tower itself rested. Therefore, the tower was free to move in any direction, and when it collapsed no injury was done to the foundation. The stalk was held in an upright position solely by means of stays made of stout wire cable. Four stays were attached to the tower at each of the four balconies and the ground

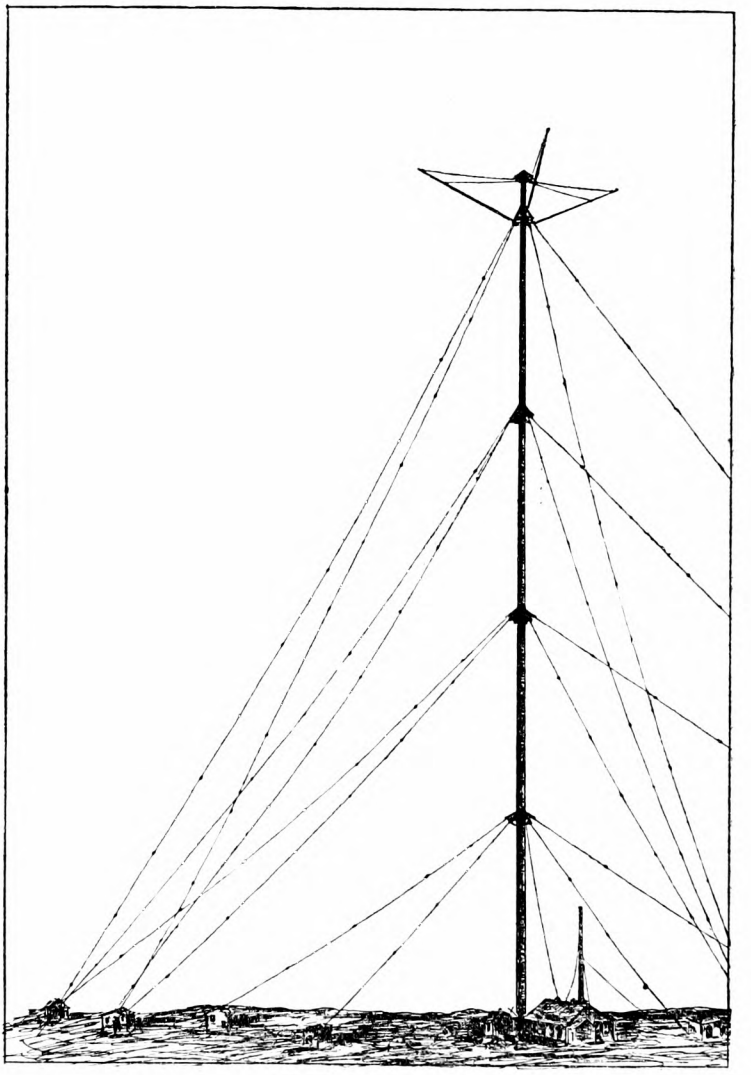


FIG. 1.—SKETCH OF TOWER, SHOWING GENERAL APPEARANCE

ends were fastened to solid concrete foundations (fig. 2), situated at distances of from one to three hundred yards from the base of the tower at points to the east, south, west and north-west of it. By these means it seems to have been thought that the resistance of the

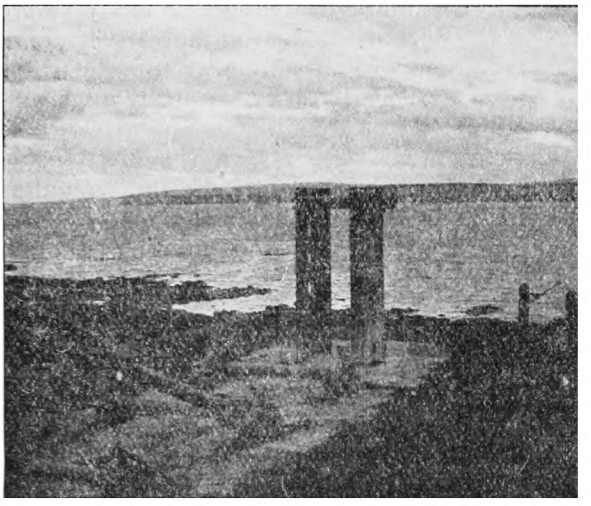


FIG. 2.—CONCRETE BLOCK, IN WHICH STAYS ARE FASTENED (DURING CONSTRUCTION).

tower to the wind would be greatly diminished, and any danger of its buckling obviated.

I have myself been up the tower during a stiff breeze, and even then the swaying was considerable, and the noise of the wind, as it rushed past, was most alarming and indicated that a great resistance was being opposed to its passage.

For several days before December 5th the wind on the west coast of Scotland was strong and gusty, and Machrihanish always has its full share if any wind is about, but the tower stood the strain well and no one was anxious about its safety.

Early on the morning of Wednesday, December 5th, the wind increased greatly and soon was blowing a severe gale from the north-west. As the day advanced the gale became worse and there were frequent squalls of most exceptional severity. About noon the storm seemed to reach its height, and the tower, which was necessarily exposed to the full force of the gale, was observed to be swaying considerably. Everything, however, held fast, although the roar of the wind

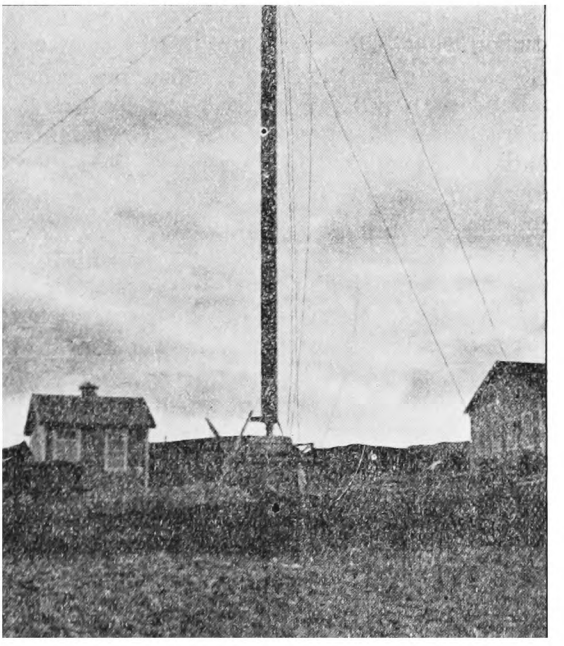


FIG. 3.—FOUNDATION OF TOWER, SHOWING PIVOT ON ON WHICH THE STRUCTURE RESTS.

against the stalk and stays was almost deafening Shortly before one o'clock in the afternoon the gusts became even more severe, and, during one of exceptional velocity, without any warning the stays to the west of the tower were wrenched from their fastenings and immediately the huge erection collapsed bodily, snapping in two as it fell. The noise of its snapping, together with the crash made when it struck the ground, was heard a long distance away, and at once informed the whole village of what had happened.

Fortunately, in falling the tower cleared the buildings, though only by a few inches, and some workmen who were in the power house had a very narrow escape. It is worthy of notice that the stays were arranged so that if any one of them broke, the tower would fall clear of the buildings, and this is what actually happened. As already stated, the stalk buckled in its fall, and the two parts fell in different directions. The first section of one hundred feet, measuring from the base, fell against the wind in a northerly direction, while the top section, composed of the remaining three hundred and twenty feet, fell towards the south. Part of the tower fell on a mound, which caused it to snap yet again. The upper portion is flattened out, owing to the momentum of its fall, and parts of it are buried more than a foot deep in the ground. Many of the tubes, needless to say, are damaged beyond all hope of repair, but it is believed that it will be possible to use some fifty per cent. of them again.

It is characteristic of the energy of those responsible for the station that the manager has got instructions from America to proceed at once with the reconstruction of the tower. This may be taken as an indication that the company's officials are still hopeful of realising the object for which the station was established. It is understood that the experiments, although encouraging, did not come up to the expectations of the inventor, but everything is being conducted so quietly that it is difficult to get trustworthy information. During the summer months, from one till four in the morning, messages were being sent off daily from the station, but how many reached the other side of the ocean it is impossible to learn. The effect at Machrihanish was most remarkable, and it was well worth rising early to see it. Underneath the six acres of ground, leased by the company, a network of wire has been laid, miles of wire having been used for this purpose, and the ground has been railed off with an ordinary wire fence. When messages are being sent off the whole place seems alive with electric sparks: sparks run along the wires of the fence, sparks seem to spring out of the ground, sparks fly through the air from all directions, and their crackling noise mingled with a dull subdued roar can be heard a quarter of a mile away.

It is unfortunately very difficult to say how the accident happened. So closely are the secrets of the company kept, that it is impossible to find out what pressure of wind the tower was built to withstand,

and of course at Machrihanish such things as anemometers are unknown. We can, therefore, only approach the subject indirectly by considering three questions.

First, was the velocity of the wind greater than could have been reasonably anticipated? A north-westerly gale at Machrihanish, coming as it does over an uninterrupted stretch of ocean, is not a thing to be despised, and I was always inclined to agree with the local opinion, that the tower would never survive a winter's gales, but this opinion was entirely unscientific and may be worth little. It is surely not too much to assume that the tower was put up to withstand a greater gale than ever has blown, or is ever likely to blow, on our shores, and we may therefore answer this question in the negative *

Second, was it owing to a mistake in calculating the pressure which the wind would exert on the tower? Without doubt, the tower was put up to resist an enormous pressure, but it seems to me that the effect of an unsteady pressure, such as would be exerted by violent gusts, could not have been sufficiently considered, and that this was the primary cause of the accident.

Third, was defective material used in the construction of the tower? Possibly this should be answered in the affirmative, for the accident undoubtedly happened owing to some of the stays giving way, and this certainly suggests that a defect in one, or some, of the stays may have been the immediate cause of the whole trouble.

LOCAL CLIMATOLOGY IN RELATION TO ORCHARD SITES.

By Alfred O. Walker, F.L.S., F.Z.S.

It is a remarkable fact that, with all the costly meteorological establishments that we possess in this country, and the enormous mass of observations that have been recorded, scarcely any attempt has been made to utilise them for the benefit of Agriculture. Still less, if possible, has any effort been made to compare the climates of the different parts of a restricted area, such as the county of Kent. Yet it will be, I think, generally conceded that in a county in which fruit growing is such an important and increasing industry, it is of the highest importance to know where orchards may be planted with the least danger from spring frosts, such as this year have ruined the plum and damson crops.

* The wind on December 5 was undoubtedly very strong along the whole of our western seaboard. At Malin Head, 60 miles due west of Machrihanish, the Meteorological Office observer estimated it at force 10 of Beaufort's scale at 8 a.m. It is a familiar joke that force 12, the maximum of the scale, can only be recorded when observer and observatory have been blown away.
—Ed. *S.M.M.*

I am well aware of the difficulty of the subject, having studied it for the last thirty years. But, after all, climate is governed by natural laws, and it seems to me that some effort should be made to find out what these are. The object of this article is to show that there is a *primâ facie* case for a properly organised and systematic inquiry into them.

Since I came to live at Ulcombe, on the south slope of the Lower Greensand or "Kentish Rag" hills, in 1899, I have been struck by the following facts:—

(1.) That many tender plants and shrubs will live and thrive with me which are killed by the winter in the immediate neighbourhood of Maidstone and in the Medway valley.

(2.) That the temperatures recorded in the Public Gardens at Maidstone show a climate of much greater extremes (*i.e.*, higher day and lower night temperatures) than with me. To give a recent instance of the latter, the grass temperature at Maidstone on September 28th was 33°, while with me it was 46°.

(3.) As far as can be judged from fruit crops, condition of the surface of the soil during frost, time of flowering of trees and plants in spring, &c., there appears to be a marked difference on the same slope at different heights, the middle portion having the most equable climate. At Ulcombe, the hill being about 300 feet high, the part between 50 feet and 200 feet is the warmest in winter. In this part there was this year quite half a crop of damsons and cherries, and the same was the case in 1903—an equally bad year. The lowest temperatures recorded in April and May were 31° on April 24th, by the shaded thermometer (the only occasion on which it was below 32° since March), and 28°·5 on the grass on April 26th. It is dangerous to generalise from a single locality, but there is no obvious reason why the same conditions should not exist along the whole Lower Greensand range which runs from east to west through the whole county. Probably much the same climate exists on the parallel Chalk range, but the soil may not be suitable for fruit.

It can hardly be denied that some localities are better adapted in climate or soil, or both, than others for fruit culture, and it must surely be worth while to endeavour to ascertain the exact position of these localities. For this purpose I suggest that competent Inspectors should be appointed whose duty it should be to ascertain and record every year those orchards in which the crops were specially good or bad. In time a mass of valuable information on the subject would be acquired, which, if properly utilised, would put an end to the waste of money involved in planting orchards in unsuitable localities. It should also be part of the duty of such Inspectors to examine and report, and perhaps advise, on all cases of insect and fungoid pests affecting fruit trees.

ROYAL METEOROLOGICAL SOCIETY.

THE opening meeting of this Society for the new session was held on Wednesday evening, November 21st, at the Institution of Civil Engineers, Great George Street, Westminster, Mr. Richard Bentley, President, in the chair.

Dr. H. R. Mill gave an account of the proceedings at the International Congress on Polar Exploration, held at Brussels from September 7th to 11th last, which he attended as the delegate of the Royal Meteorological Society. The resolutions bearing on meteorology which were adopted by the Congress were the following: —

(1) That researches and studies be undertaken in order to construct recording instruments which may be left for longer or shorter periods in uninhabited polar regions.

(2) That Polar Expeditions be furnished with an equipment of kites for the study of the upper air.

(3) The Committee desire to see permanent stations installed in the countries near the poles, wherever it is possible, and to see temporary stations organised at the greatest possible number of points during the continuance of Polar Expeditions.

(4) That Polar Expeditions should be undertaken in the two hemispheres simultaneously.

(5) That during these expeditions meteorological and magnetic observations be made as far as possible exactly in the places where they were made during the international co-operation of 1882–83.

(6) That detailed observations of the phenomena of the upper atmosphere be specially recommended to Polar Expeditions.

(7) In order to secure uniformity in the meteorological and magnetic observations it is desirable that, before their departure, all Polar Expeditions should enter into communication with the permanent International Meteorological Committee.

Mr. W. Marriott read a paper on "The Abnormal Weather of the Past Summer and some of its Effects," which he illustrated with a number of lantern slides. The principal features of the weather over the greater part of England—especially the south-east—were the high state of the barometer throughout the whole of the period, except a portion of August; the high temperature in July, August and September; the great amount of sunshine; and the deficiency of rainfall. Over the south-eastern portion of England more than 900 hours of bright sunshine were recorded during the four months June to September; while at a few stations in the extreme south and on the east coast over 1000 hours were recorded. The sunshine was more than 200 hours above the average over the Thames basin

and on the coasts of Lancashire and North Wales. The most remarkable feature of the weather during the past summer was the exceptional heat wave which occurred between August 30 and September 3. The temperature rose above 90° over a large part of England on the four consecutive days—August 31 to September 3. Mr. Marriott said that he had not been able to find any previous record of readings over 90° for a similar period. The air was very clear, and brilliant sunshine prevailed over nearly the whole of the country. Another remarkable feature connected with this heat wave was the great dryness of the air; for on September 1 and 2, differences of 25° were observed between the readings of the dry and wet bulb thermometers, and relative humidities below 30 per cent. were recorded at many inland places. Owing to the great heat, vegetable matter became very inflammable, and consequently there were more stack fires than usual, and extensive stretches of heather and gorse were also set on fire. The author said that with the advent of the hot weather the death rate increased considerably; and he pointed out that when the mean maximum temperature for the week reached 72° the death rate at once began to rise. The increase of the death rate was made up almost entirely of infants under one year of age. This was shown to be due to the prevalence of epidemic infantile diarrhœa, which sets in when the mean maximum temperature for the week rises above 72°. Attention was called to the effect which the high temperature had in turning milk sour and in rendering it unfit for drinking purposes, unless it had been first Pasteurized or sterilized. Not only was the ordinary milk a source of danger to infants during the hot weather, but the great use which is now made of tinned foods also tended to produce ptomaine poisoning and cause diarrhœa. Owing to the drought "keeping" for cattle was very deficient, and consequently there was a falling off in the milk supply of as much as 30 per cent. The brilliant sunshine and the warm weather had a great effect upon holiday traffic, for more visitors than usual went to the various seaside and holiday resorts, and outdoor entertainments were successfully carried on without any interruption.

Dr. W. N. Shaw, Mr. W. H. Dines, Mr. F J. Brodie, Captain M. W. C. Hepworth, Mr. W. W. Bryant, Dr. H. R. Mill, Mr. F. Druce, Mr. H. Southall, and the President, took part in the discussion on this paper, and Mr. Marriott replied.

The following were elected Fellows of the Society:—Mr. W. R. Baldwin-Wiseman, Assoc. M.Inst., C E., Mr. W. W. Bryant, F.R.A.S., Lieut. Hon. F. G. P. Butler, R.N., Mr. J. R. Gibbs, Mr. H. J. W. Gidley, Prof. J. W. Hoffman, Mr. E. W. Kitchin, Assoc. M.Inst., C.E., Mrs. M. Lane, Mr. C. L. J. M. Parkinson, M.A., Mr. H. J. B. Powell, Assoc. M.Inst., C.E., Mr. A. S. Tuxford, and the Hon. H. A. Wyndham.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

THE GREEN FLASH.

With reference to the letter of Mr. R. C. Cann Lippincott on the Green Ray, in the Magazine for this month, I desire to state that on several occasions I had the opportunity of observing this phenomenon on board the "Durham Castle," while we were passing up the Red Sea. The ray appeared to me to be bluish-green, and I cannot say that I ever observed the emerald-green noticed by others. My physiological studies of subjective colour phenomena led me at first to account for the green or bluish-green ray on the physiological theory; but when I noticed that the phenomenon was seen not when the portion of the sun's disc was red, but when it had a yellowish tinge, and further when I saw the phenomenon at *sunrise*, as described by Dr. Rambaut in his admirable article, I became at once a convert to the physical theory. Dr. Rambaut's arguments are absolutely convincing, and they give a rational explanation which I feel sure will convince anyone who studies them carefully. JOHN G. McKENDRICK.

Maxieburn, Stonehaven, 26th November, 1906.

It is to me very difficult to understand how anyone who has observed the green flash, and has carefully read Professor Rambaut's admirable papers (pp. 21-23 and 41-45), can doubt that the true cause of the phenomenon is atmospheric dispersion. But, as at least one of your correspondents (p. 190) still believes the flash to be merely a subjective colour due to physiological causes, I should like briefly to demonstrate that such cannot be the case. The fact that the flash has often been seen just before sunrise is, as the Editor pointed out (p. 11), a disproof of the hypothesis that the appearance is due to retinal fatigue; but I wish to add from my own experience an even more conclusive disproof.

The sun was sinking behind a low horizontal narrow bank of cloud, between which and the horizon was a strip of clear sky. Just as the top of the sun disappeared behind the upper edge of the cloud, I saw a green flash, and just as the base of the sun appeared below the lower edge of the cloud, I saw a red flash.

Both flashes are simply and completely explained by dispersion, but it is impossible to explain the flashes physiologically, except on the hypothesis that the sun's disc was first red and then, a few minutes later, green! As a matter of fact, the disc was yellow all the time.

Under exceptionally good conditions, the flash is blue rather than green; and I have seen the flash change from green to blue, the blue

being followed by a faint feathery wisp of violet—a rare and beautiful close.

I may add that on clear days I have watched the low sun dozens of times with a telescope (power about 100), and have invariably noticed that the upper part of the disc is fringed with bluish-green, and the lower part with orange-red, the atmosphere acting like a prism, with the refracting edge upward. As the sun sinks, both fringes grow in colour and in breadth, and at sunset—without any breach of continuity—the upper fringe becomes the green flash, always visible in clear weather with a telescope of sufficient power, but not always developed enough to be seen by the naked eye.

It may be of interest to mention that, with the aid of a telescope, the green flash has also been seen at the setting of the planet Jupiter; and, as the image of every star observed telescopically near the horizon is drawn out into a short vertical spectrum, I see no reason to doubt that, under favourable conditions, the green flash could be telescopically observed at star-set in the case of bright stars.

C. T. WHITMELL.

Leeds, 25th October, 1906.

MR WHITMELL'S letter in your last number indicates what appears to be the best method of attacking the question why the Green Flash is so seldom seen. It is possible to guess at the reasons why he failed to see it on the four occasions specified by him, and if other competent observers were to record their experiences in like manner, it would soon be discovered whether these guesses were correct, or the explanation had to be sought elsewhere. In Nos. 1 and 2 the non-appearance of the flash may have been associated with the colour of the sun, for reasons previously stated. Another of the three determining factors referred to by Mr. Whitmell, viz.: "the refractive condition of the air," may have been responsible for the failure in the case of No. 5, as the sun set behind a ridge of Snowdon, and consequently the atmospheric refraction would not be so great as if it had set at a lower altitude. This factor may also have operated to a slight extent in No. 3, but the bank of cloud seems to have been too low to account fully for the non-appearance of the flash. Perhaps some of the less refrangible rays from the sun, which would otherwise have passed over the observer's head, may have grazed the lower surfaces of minute water drops in the cloud and been reflected downwards so as to reach the eye along with the flash, and thus neutralize its green colour.

If the green flash were a complementary effect, as suggested by Mr. Lippincott, it should be best seen when the sun is of a reddish colour, but the reverse is rather found to be the case.

ALEX. THURBURN.

Keith.

WHY?

THE children in a country school (who keep a rain record) propounded two questions a week or two ago, which I found it difficult to answer. Perhaps you will kindly inform them and me—

(1) Why do rain-drops differ so much in size?

(2) Why is the distant view, across the Severn to the Welsh hills, often so remarkably clear before rain? A. F.

[These questions are easy to ask, but though we could discourse on both topics for a considerable time, we could not formulate concise replies that would have any chance of satisfying the questioners. We invite answers from our readers, but restrict each answer to fifty words as a maximum.—ED. *S.M.M.*]

THE SUMMER RAINFALL OF 1906.

IF it is not too late, I should like to put before your readers some figures of the Mid-Wessex Rainfall Association which will serve to corroborate *both* sides of the contrast given in letters which you have published—from Mr. Horner, of Worthing, in September, and from Earl Waldegrave, of Chewton Priory (on the N. slope of the Mendip Hills) in October, the first affirming a remarkable summer drought, the second a very ample summer rainfall.

Our Association covers an area of about 35 miles diameter, with 32 corresponding members. On its outer edge are found Glastonbury, Cranmore, Mere (Wilts), Shaftesbury, Sturminster Newton, Sherborne, Beaminster, Crewkerne and Langport. If through the centre of this district a line be drawn E. and W., the region to the S. of it is that where most rain was to be expected, and where in January, February, October and November most actually fell. But for seven months in succession, March to September, this condition was most remarkably reversed. Towards Devon and in Dorset the rainfall was very low through all those months. Even in May two stations near the Devonshire border registered less than 2 inches, and in other months totals below 1 inch were common to the S. of the said line. But to the N. of it May gave from 4 to 5½ inches, and in the three summer months there was not even one case of a monthly total below the inch. In September half our stations recorded less than an inch, but all those which reported less than ·80 in. were either on the line or well to the south of it.

The northernmost of our stations is at Cranmore Hall Gardens, 8 miles from Chewton Priory, at the same elevation, *i.e.*, nearly 600 ft., but on the S. side of the Mendip ridge. Here the rainfall for June, July and August was 6·82 in., being the highest but one on our list, and not so very far short of Earl Waldegrave's 8·75 in.

Our southernmost station is Beaminster, ordinarily having much the same rainfall as Cranmore. Its rainfall for the same period was

3·64 in., quite the lowest on our list, and not so very much more than Mr. Horner's 2·97 in.

Careful records have been kept at Cranmore now for 20 years, and Mr. Moore reports that this year's aggregate for the first 11 months has in that time been exceeded only twice—viz., in 1894 and 1903.

H. A. BOYS, F.R.Met.Soc.

North Cadbury Rectory, Somerset, Dec. 4th, 1906.

METEORS AND FIREBALLS.

MR. HUNTLEY has put a "?" after his title "an audible meteor" on p. 190. I do not know whether he doubts that what he saw was a meteor, or that a meteor emits an audible sound. That there is no room for doubt on the latter point is proved by many instances, of which I may recall a few—for memory as to such things is short-lived.

The great meteor of November 20th, 1887, was heard at many points throughout its course from Newmarket to near Swindon. See *Met. Mag.*, Vol **22**, pp. 161–167; also *Trans. Hertford Nat. Hist. Society*, Vol. **5**, part 2.

That of January 25th, 1894 (*Met. Mag.*, Vol. **29**, p. 8) was heard across Herefordshire, Worcester and Gloucestershire.

The Madrid meteor of February 10th, 1896 (*Met. Mag.*, Vol. **31**, pp. 11, 25) produced a sound which lasted two minutes.

The daylight meteor of January 9th, 1900 (*Met. Mag.*, Vol. **35**, p. 6) produced "sounds resembling peals of thunder"; and, elsewhere, "a long trail of smoke with a rumbling noise in the air."

Whether the sounds which accompanied the Hereford earthquake and meteors of December 17th, 1896, were due at all to the latter must remain an open question.

The Editor's note on "The Fireball of May 13th" (p. 191), "that it does not follow that the impression produced on the eye by a sudden light corresponds to the real phenomenon," recalls an occurrence which I received a full account of at the time, but have not hitherto reported.

It happened sometime since at a large isolated house in Herefordshire. A heavy thunderstorm was in progress. A visitor, a scientific observer, was watching it from the dining-room window, which looks east over the lawn and grounds in front of the house away to the Malvern Hills. The servants were in the servants' hall at the back of the house, with windows looking south into a large courtyard surrounded, except to the west, by high buildings. A loud explosion was heard. The visitor in the dining-room saw a large ball of fire apparently descend and burst upon the lawn. At the same moment, the servants saw a similar ball descend and burst upon the woodstack in the S.W. corner of the courtyard. Careful

examination immediately followed. No damage was found to any of the buildings or the lawn, and the woodstack was undisturbed.

Unless we assume a plurality of "fireballs" at the same instant (for there was but one explosion), which seems most improbable, it is obvious that none of the observers saw the actual flash. Their eyes were affected by the effect of the sudden light of the flash (wherever it was) upon the particular point to which their gaze at the moment was directed; in the one case the lawn, in the other the woodstack.

I have long doubted whether the zig-zag lines which we are accustomed to regard as the actual discharges are such in fact; at least in many instances. That we do often see the actual discharge I do not deny. This doubt was borne in upon me while observing a storm at Charlton Kings, August 21st, 1898 (*Met. Mag.*, Vol. **33**, p. 136). The storm with heavy rain approached from the direction of Gloucester. I noticed several flashes all taking, apparently, the same zig-zag path. Suddenly the rain ceased, the nimbus cloud opened in a great rift, revealing behind it a sharply-defined mass of electrical cumulus with an edge, lit by the setting sun, exactly in the position of, and with an outline corresponding to, the apparent path of the flashes which I had been watching. Evidently what I had seen was the reflection from the surface of the cloud of a flash behind or within the cloud.

If this is so, it explains the phenomena of the ribbon-flash frequently seen in photographs. If a second discharge occurs before the plate is removed a second image of the outline of the cloud would appear at a slight distance from, but parallel to, the former figure, the cloud having moved slightly between the two discharges, and thus the combined images would present the appearances of a ribbon with two bright edges, the interval being affected by a double exposure.

The phenomenon at Morchard Bishop appears to me explicable as follows. The observer looking through the space between the trees could not locate either the distance or the plane of what he thought was the descent of a ball. The apparent breaking up of the ball into sparks of fire would be the lighting up of a low bank of ragged clouds. Those who watched the storm of August 2nd in this year, will see an analogy to the extraordinary coruscations then observed, only those appeared to pass upward instead of downward.

JAMES G. WOOD.

115, Sutherland Avenue, W., November 17th, 1906.

[In justice to Mr. Huntley, we must state that the title of his letter, "?" and all, was editorial, but in justice to ourselves we may point out that in the "Contents" the "?" was removed on the better impulse of a second thought.—Ed., *S.M.M.*]

A LUNAR DOUBLE RAINBOW.

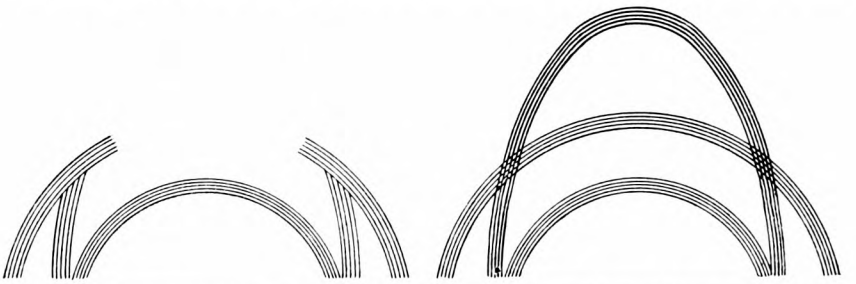
IT may interest your readers to learn that shortly before 8 o'clock of the evening of Thursday, November 29th, a splendid lunar double rainbow with prismatic colours was seen from this, stretching across the western horizon. In the primary bow the several colours of the spectrum were clearly visible. The secondary arch was faint and gave the pale white light usual in lunar rainbows. A moderate W.S.W. gale was blowing at the time, and on it were borne numerous showers of fine rain. While the beautiful bow adorned the western horizon, in the eastern part of the zenith a coloured corona surrounded the moon. A double coloured lunar rainbow is, I believe, very uncommon. The phenomenon was greatly admired by all those who were fortunate enough to observe it.

ARTHUR R. MOORE, B.A., B.L.

40, Fitzwilliam Square West, Dublin, Dec. 4th, 1906.

RAINBOWS.

THIS afternoon we saw a *very* bright, but not perfect, treble rainbow, partly as sketched below (Fig. 1)—the top parts invisible, the lower parts of all three very bright. Some 30 years ago I saw a *perfect* treble rainbow, but cannot quite remember whether the top was pointed or shaped like an egg, as I have sketched (Fig. 2). At that



time there was also another faint round one, making *four*. Are they often seen? W. R. NASH.

Carke-in-Cartmel, 17th October, 1906.

AURORA BOREALIS.

A VERY bright display of Aurora was visible here on November 16th, being first observed at 6 a.m., about an hour and a half before sunrise. The greater part of the sky was covered with thin cirro-stratus, through which the brighter stars were visible. The primary arc of the Aurora spanned the sky from about N.E. to S., and was distinctly brighter on the N.E. side. Beneath the lowest arc the segment of sky was of a greyish hue. It was apparent that several arcs entered into the composition, the lowest being of a deep greenish blue hue, the second a vivid yellow, and the whole being

surmounted by an arc of a rosy hue. From the primary arc there was a frequent display of rays and streamers, varying in colour from pale pink to blood red, and appearing to spring from a centre at about E.S.E. Much of the brilliance of the display was lost, owing to the rapid approach of dawn, but distinct traces of the phenomenon were still visible at 7.15 a.m., and then appeared to be slowly breaking up, the red being the last to disappear. At 9 a.m. on the same day there was a very bright prismatic solar halo, and in the S.E. a peculiar shimmering glow of a pink hue, varying in intensity of colour, with a twitching movement.

It is certainly a somewhat remarkable coincidence that the last brilliant auroral display occurred almost exactly a year ago, November 15th, 1905. (See this Magazine for December, 1905.)

SPENCER C. RUSSELL, F.R.Met.Soc.

Parkside, Ashley Road, Epsom, Nov. 17th, 1906.

METEOROLOGICAL NEWS AND NOTES.

PROFESSOR MASCART is, we learn, retiring from the position of Director of the Central Bureau of Meteorology in Paris, and he will be succeeded in that post by M. Angot.

INFORMAL METEOROLOGICAL DISCUSSIONS have again been arranged at the Meteorological Office, 63, Victoria Street, Westminster, for the purpose of considering important contributions to Meteorological literature, particularly papers by foreign and colonial authors Two meetings have already been held, the remainder are provisionally arranged for the following Mondays in 1907, at 5 p.m.: January 14th and 28th, February 11th and 25th, March 11th and 25th. Dr. Shaw will be glad if any persons interested in meteorology would attend and take part in the discussions.

MR. W. MARRIOTT will lecture on meteorological subjects on behalf of the Royal Meteorological Society at the Literary and Scientific Institution, Highgate, on December 18th, and to the Young People's Society at the Oaklands Congregational Church, Uxbridge, on January 15th.

THE RAINFALL OF NOVEMBER, 1907, in the British Isles, was remarkably uniform over the country, the dry eastern regions showing a large excess over the average, and the wet western regions showing a corresponding deficiency. Ireland was very dry, especially in the south; and the whole of Cornwall, Devon, Somerset, Wales, Cheshire, part of Lancashire, the Southern Uplands, and west coast of Scotland had less than the average, while several stations in Kent had nearly twice the average fall, and some in the north-east of Scotland more than twice. The eleven months of 1907 showed a close approach to average rainfall. The general percentage of the average for England and Wales was 101, for Scotland 108, and for Ireland 95; the British Isles as a whole coming out at 101.

TEMPERATURE FOR NOVEMBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [-E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32° Shade.	Grass.
Camden Square	*London*	51 32	0 8	111	60·1	22	29·7	19	3	5
Tenterden	*Kent*	51 4	*0 41	190	60·0	22	31·0	19	1	7
West Dean	*Hampshire*	51 3	1 38	137	59·0	22	22·0	13	5	11
Hartley Wintney	,,	51 18	0 53	222	59·0	22	24·0	12	5	8
Hitchin	*Hertfordshire*	51 57	0 17	238	61·0	22	28·0	13‡	4	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	60·0	22	26·0	19	4	11
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	60·5	21	28·5	19	4	...
Brundall	*Norfolk*	52 37	*1 26	66	...	...	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	57·0	22	24·7	13	8	12
Torquay (Cary Green)	*Devon*	50 28	3 32	12	59·2	22	32·7	13	0	7
Polapit Tamar [Launceston]	,,	50 40	4 22	315	58·5	22	21·5	13	6	13
Bath	*Somerset*	51 23	2 21	67	60·2	22	24·5	13	7	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	60·0	22	29·0	12	4	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	58·0	22, 25	23·5	19	16	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	58·0	22	24·0	18	10	...
Boston	*Lincolnshire*	52 58	0 1	25	60·0	22	29·0	19	2	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	59·9	22	29·2	6	4	13
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	...	...	...	...	...	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	59·0	22	30·5	19	1	10
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	..	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	60·0	22	30·0	19	2	9
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	56·6	24	32·6	19	0	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	..	..	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	56·5	21	30·2	5	5	12
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	58·0	22	23·0	10	...	...
Llandudno	*Carnarron*	53 20	3 50	72	62·0	22	34·0	14	0	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	56·0	22, 23	29·0	19	4	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	58·0	25	26·0	18	7	14
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	60·3	24	33·4	18	0	4
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	57·0	21	27·0	9	2	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	57·0	21, 22	32·0	5§	4	18
Tighnabruaich	*Argyll*	55 55	5 14	50	...	...	28·0	9	8	9
Mull (Quinish)	,,	56 36	6 13	35	57·0	22	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	58·4	22	32·0	10	1	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	58·0	24, 28	26·0	20	6	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	62·0	23	31·0	21	4	...
Castletown	*Caithness*	58 35	3 23	100	62·0	23	28·0	10‖	8	10
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	63·0	25	29·0	1	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	56·5	16, 26	26·0	3	5	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	59·0	25	26·0	19	7	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	64·4	24	33·0	20	0	7
Ballinasloe	*Galway*	53 20	8 15	160	67·0	22, 23	24·0	2	9	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	55·0	22	29·0	10	4	8
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	59·0	22, 23	27·0	17	9	10

‡ and 19, 20. § and 9, 18, 20. ‖ and 17, 21, 22.

RAINFALL FOR NOVEMBER, 1906.

RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.					
Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.	Mean Annual 1870-1899.	STATION.
in.	in.	in.		in.	Date.		in.	in.	in.		in.	
2·45	4·20	+1·75	171	·93	8	17	23·04	22·06	— ·98	96	25·16	Camden Square
3·22	5·80	+2·58	180	·88	4	22	25·62	25·35	— ·27	99	28·36	Tenterden
3·25	4·05	+ ·80	125	·95	8	21	27·19	28·05	+ ·86	103	29·93	West Dean
3·03	3·96	+ ·93	131	·85	8	18	24·55	24·26	— ·29	99	27·10	Hartley Wintney
2·56	4·02	+1·46	157	1·26	8	17	22·61	23·23	+ ·62	103	24·66	Hitchin
2·63	3·89	+1·26	148	1·67	8	14	24·48	23·53	— ·95	96	26·75	Addington
2·50	3·83	+1·33	153	·77	8	16	23·28	24·65	+1·37	106	25·39	Westley
2·71	4·25	+1·54	157	·95	8	22	23·27	26·23	+2·96	113	25·40	Brundall
4·82	4·77	— ·05	99	1·03	20	19	34·87	36·71	+1·84	105	39·00	Winterbourne Stpltn
3·71	3·48	— ·23	94	·78	8	20	31·54	27·00	—4·54	86	35·00	Torquay
4·29	4·17	— ·12	97	·78	20	21	34·46	35·55	+1·09	103	38·85	Polapit Tamar
3·06	3·00	— ·06	98	·85	8	17	27·99	25·37	—2·62	91	30·75	Bath
2·99	3·79	+ ·80	127	1·37	8	16	27·37	25·37	—2·00	93	29·85	Stroud
3·18	3·60	+ ·42	113	·75	8	20	30·12	26·97	—3·15	90	33·04	Woolstaston
2·27	2·33	+ ·06	103	·54	8	10	22·55	21·49	—1·06	95	24·50	Bromsgrove
2·14	2·84	+ ·70	133	·70	8	16	21·51	21·40	— ·11	99	23·30	Boston
2·10	2·72	+ ·62	130	·67	8	16	22·68	20·90	—1·78	92	24·70	Hodsock Priory
2·28	2·60	+ ·32	114	...	...	..	23·90	21·73	—2·17	91	26·18	Derby
3·91	3·74	— ·17	96	·67	16	18	38·24	44·64	+6·40	117	42·43	Bolton
2·23	3·67	+1·44	165	·70	4	20	24·77	25·55	+ ·78	103	26·96	Ribston Hall
6·00	7·70	+1·70	128	1·20	29	25	54·55	62·33	+7·78	114	60·96	Arncliffe Vic.
2·45	3·61	+1·16	147	1·13	8	17	24·66	23·48	—1·18	95	27·02	Hull
2·65	3·32	+ ·67	125	1·03	2	18	25·35	26·35	+1·00	104	27·99	Newcastle
13·91	13·85	— ·06	100	2·30	28	20	117·98	118·91	+ ·93	101	132·68	Seathwaite
4·26	3·85	— ·41	90	·82	20	20	38·38	40·74	+2·36	106	42·81	Cardiff
5·41	4·23	—1·18	78	·86	20	21	42·66	45·56	+2·90	107	47·88	Haverfordwest
4·68	3·09	—1·59	66	·64	18	17	40·92	42·37	+1·45	104	45·41	Gogerddan
3·38	2·46	— ·92	73	·66	18	15	28·03	29·08	+1·05	104	30·98	Llandudno
4·50	3·46	—1·04	77	·54	2	16	38·75	41·25	+2·50	106	43·43	Cargen
3·29	2·88	— ·41	88	·31	1	21	29·86	31·62	+1·76	106	33·04	Riddell House
...	3·61	...	...	·61	7	20	...	30·07	...	...	...	Edinburgh
4·87	3·30	—1·57	68	·74	2	18	40·03	36·94	—3·09	92	44·85	Colmonell
3·48	4·32	+ ·84	124	·57	29	19	32·27	36·59	+4·32	113	35·80	Glasgow
6·21	5·84	— ·37	94	·85	29	21	51·57	60·27	+8·70	117	57·90	Tighnabruaich
6·43	5·43	—1·10	84	·72	21	22	51·05	48·17	—2·88	94	57·53	Quinish
2·76	3·75	+ ·99	136	·85	1	17	26·22	24·95	—1·26	95	28·95	Dundee
3·94	6·72	+2·78	171	...	...	...	32·92	35·04	+2·12	106	36·07	Braemar
3·47	4·34	+ ·87	125	·78	5	19	29·62	31·47	+1·85	106	33·01	Aberdeen
2·65	5·24	+2·59	198	1·06	17	20	26·84	29·98	+3·14	112	29·37	Cawdor
5·98	6·71	+ ·73	112	1·25	29	18	49·33	53·52	+4·19	108	56·00	Invergarry
9·79	11·75	+1·96	120	1·87	17	23	77·46	84·95	+7·49	110	86·50	Bendamph
3·26	8·66	+5·40	266	1·77	19	20	28·21	38·19	+9·98	135	31·60	Dunrobin Castle
...	5·97	...	...	·87	17	28	...	34·47	...	..	...	Castletown
5·85	3·08	—2·77	53	·66	22	23	51·47	41·41	—10·06	80	58·11	Killarney
3·91	2·17	—1·74	56	·71	20	14	34·99	30·93	—4·06	88	39·30	Waterford
3·19	1·58	—1·61	50	·28	20	17	30·10	33·21	+3·11	110	33·47	Hurdlestown
3·14	1·67	—1·47	53	·30	14	14	30·98	25·47	—5·51	82	34·44	Carlow
2·60	1·56	—1·04	60	·26	4	17	25·36	21·00	—4·36	83	27·75	Dublin
3·60	1·62	—1·98	45	·24	29	21	33·41	33·67	+ ·26	101	37·04	Ballinasloe
8·25	5·52	—2·73	67	·60	14	19	71·24	65·14	—6·10	91	80·23	Kylemore House
5·63	3·46	—2·17	61	·78	21	23	44·69	45·42	+ ·73	102	50·50	Enniscoe
3·94	2·74	—1·20	70	·39	19	20	34·97	30·59	—4·38	87	38·61	Seaforde
4·19	4·62	+ ·43	110	·49	19	21	36·89	38·47	+1·58	104	41·20	Londonderry
3 ·53	3·74	+ ·21	106	·45	18, 26	21	34·08	39·00	+4·92	114	37·85	Omagh

SUPPLEMENTARY RAINFALL, NOVEMBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	6·04	XI.	Rhayader, Tyrmynydd	5·62
,,	Ramsgate, West Cliff Villas	4·57	,,	Lake Vyrnwy	4·99
,,	Hailsham	7·26	,,	Llangyhanfal, Plâs Draw	2·18
,,	Crowborough, Uckfield Lodge	8·92	,,	Criccieth, Talarvor	1·91
,,	Osborne, Newbarn Cottage.	4·74	,,	Llanberis, Pen-y-pass	11·90
,,	Emsworth, Redlands	4·73	,,	Lligwy	2·89
,,	Alton, Ashdell	4·81	,,	Douglas, Woodville	4·30
,,	Newbury, Welford Park	5·20	XII.	Stoneykirk, Ardwell House	3·25
III.	Harrow Weald, Hill House.	4·14	,,	Dalry, The Old Garroch	5·99
,,	Oxford, Magdalen College..	3·20	,,	Langholm, Drove Road	4·77
,,	Bloxham Grove	3·59	,,	Moniaive, Maxwelton House	3·93
,,	Pitsford, Sedgebrook	3·60	XIII.	N. Esk Reservoir [Penicuick]	6·60
,,	Huntingdon, Brampton	4·02	XIV.	Maybole, Knockdon Farm..	3·40
,,	Wisbech, Bank House	2·90	XV.	Campbeltown, Witchburn	5·91
IV.	Southend Water Works	4·37	,,	Inveraray, Newtown	7·63
,,	Colchester, Lexden	4·09	,,	Ballachulish House	6·48
,,	Newport, The Vicarage	4·12	,,	Islay, Eallabus	5·00
,,	Rendlesham	4·01	XVI.	Dollar Academy	4·71
,,	Swaffham	3·44	,,	Loch Leven Sluice	4·64
,,	Blakeney	3·78	,,	Balquhidder, Stronvar	...
V.	Bishops Cannings	3·31	,,	Perth, Pitcullen House	3·57
,,	Ashburton, Druid House	4·44	,,	Coupar Angus Station	3·67
,,	Okehampton, Oaklands	4·55	,,	Blair Atholl	4·29
,,	Hartland Abbey	3·17	,,	Montrose, Sunnyside Asylum	3·87
,,	Lynmouth, Rock House	5·20	XVII.	Alford, Lynturk Manse	6·78
,,	Probus, Lamellyn	3·78	,,	Keith Station	7·66
,,	Wellington, The Avenue	3·27	XVIII.	N. Uist, Lochmaddy	4·09
,,	North Cadbury Rectory	2·96	,,	Alvey Manse	6·26
VI.	Clifton, Pembroke Road	2·90	,,	Loch Ness, Drumnadrochit.	3·45
,,	Moreton-in-Marsh, Longboro'	3·51	,,	Glencarron Lodge	11·38
,,	Ross, The Graig	2·42	,,	Fearn, Lower Pitkerrie	5·46
,,	Shifnal, Hatton Grange	3·04	XIX.	Invershin	8·19
,,	Cheadle, The Heath House.	3·03	,,	Altnaharra	8·66
,,	Coventry, Kingswood	2·98	,,	Bettyhill	6·78
VII.	Market Overton	4·01	,,	Watten Station	4·58
,,	Market Rasen	3·85	XX.	Dunmanway, The Rectory..	4·07
,,	Bawtry, Hesley Hall	2·58	,,	Cork	3·14
VIII.	Neston, Hinderton	1·81	,,	Darrynane Abbey	3·50
,,	Southport, Hesketh Park	2·48	,,	Glenam [Clonmel]	2·04
,,	Chatburn, Middlewood	4·59	,,	Ballingarry, Gurteen	1·88
,,	Cartmel, Flookburgh	3·91	,,	Miltown Malbay	3·01
IX.	Langsett Moor, Up. Midhope	5·70	XXI.	Gorey, Courtown House	2·22
,,	Scarborough, Scalby	3·68	,,	Moynalty, Westland	1·91
,,	Ingleby Greenhow	4·86	,,	Athlone, Twyford	1·41
,,	Mickleton	3·85	,,	Mullingar, Belvedere	2·44
X.	Bardon Mill, Beltingham	3·35	XXII.	Woodlawn	2·23
,,	Ewesley, Fallowlees	4·27	,,	Westport, Murrisk Abbey..	2·96
,,	Ilderton, Lilburn Cottage..	2·65	,,	Collooney, Markree Obsy..	2·82
,,	Keswick, York Bank	4·84	XXIII.	Enniskillen, Portora	2·87
XI.	Llanfrechfa Grange	3·55	,,	Warrenpoint, Summer Hill.	2·53
,,	Treherbert, Tyn-y-waun	7·94	,,	Banbridge, Milltown	2·62
,,	Carmarthen, The Friary	4·32	,,	Belfast, Springfield	3·41
,,	Castle Malgwyn [Llechryd].	3·33	,,	Bushmills, Dundarave	3·90
,,	Plynlimon	10·65	,,	Stewartstown, The Square..	2·69
,,	Tall-y-llyn	3·70	,,	Killybegs	7·73
,,	New Radnor, Ednol	4·24	,,	Horn Head	4·88

METEOROLOGICAL NOTES ON NOVEMBER, 1906.

Abbreviations.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

London, Camden Square.—Another persistently mild month; the max. temp. failed to reach 50° on 6 days only, and the mean temp. was 46°·7, or 3°·7 above the average. The first and third weeks were decidedly wet, and sunless and gloomy conditions were prevalent almost throughout. Duration of sunshine 29·9* hours and of R 68·3 hours.

Tenterden.—The wettest month since February, 1900, and the wettest November since 1877; but notwithstanding, the well water was at the same level as in August. Mean temp. 47°·1. Duration of sunshine 44·5† hours.

Crowborough.—Gloomy and wet with few sunny intervals. The R was more than double the average of 35 years and the greatest in November since 1877, when 9·04 in. fell. Mean temp. 45°·3.

Osborne.—R 50 per cent. above the average of 48 years.

Torquay.—Duration of sunshine 72·9* hours, or 3·6 hours above average. Mean temp. 47°·6, or 0°·2 above the average. Mean amount of ozone 4·1.

Ross.—The last week was very fine and warmer than ever known so late in November. The max. temp., 60°·7 on 22nd, was also a record. Much fog.

Bolton.—Generally mild and open, with deficiency of sunshine. The duration of sunshine was only 14·1 hours, or 9·7 hours below the average. Mean temp. 44°·7, or 1°·9 above the average.

Southport.—Characterized by numerous trying changes of temp., including an unusually low min. and an exceptionally high max. Mean temp. 45°·4, or 1°·4 above the average. Duration of sunshine 45·6* hours, or 3·4 hours below the average, and of R 43·1 hours.

Carmarthen.—Generally wet, gloomy and dull, with few fine dry days. Mild, with only slight frosts, the foliage remained unusually long on the trees.

Douglas.—Wet and sunless, with an almost unbroken series of gales, especially severe at night. Cold to 22nd, but very mild thereafter, the temp. exceeding the average by upwards of 6° in the last week.

Coupar Angus.—The mean temp., as in the three preceding months, was above the average, being 43°·4. R ·73 in. above the average.

Blair Atholl.—Remarkably mild, especially from 21st to 29th. On 12th and 13th ripe raspberries were gathered in the open garden.

Lynturk.—The R was much above the average, 3·00 in. falling on 1st and 2nd and 4·63 in. on the first five days. Strong winds in the latter half.

Drumnadrochit.—R ·33 in., and rain days 6, above the average of 20 years. The whole month was genial with high temp., and its chief feature was the extraordinary rise of temp. on the morning of 22nd.

Watten.—Wet and stormy with fine and mild intervals; little frost.

Dunmanway.—A mild month, especially from 21st to 29th, with little frost. The R was not large for November, but the atmosphere was extremely damp from 21st to the end.

Cork.—R ·92 in. below, and mean temp. 1°·3 below, the average.

Darrynane.—R 68 per cent. of the average.

Markree Observatory.—On the whole mild and damp, but the R was not above the average. Several gales with H from 15th to the end.

Dublin.—Open, cloudy and windy, but with quiet cold spells at the beginning and from 17th to 21st. On the latter date a remarkable period of warmth began suddenly, lasting till the close. The mean temp. of 22nd was 60°·0, or 16°·0 above the average, and the mean temp. of the month was 47°·6, or 2°·2 above the average. Sharp TS on 4th.

Omagh.—The month commenced damp and humid, giving way in the second week to a spell of remarkably fine and rainless weather. Another wet, cold and stormy interval occurred from 13th to 21st, but the mildness of the remainder of the month was quite extraordinary.

* Campbell-Stokes. † Jordan.

Climatological Table for the British Empire, June, 1906.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	80·9	20	39·8	5	71·7	49·5	51·5	75	131·9	32·9	2·89	8	...
Malta	89·0	30	58·3	11	80·3	64·6	62·3	75	...	52·1	·07	2	2·9
Lagos	87·5	11	71·0	15	83·9	73·9	78·6	80	137·0	69·0	22·30	21	8·1
Cape Town	75·2	15	40·6	27	62·6	50·1	48·8	76	...	...	2·63	13	5·3
Durban, Natal	82·4	17	50·8	27	76·7	54·6	...	...	132·4	...	1·02	5	1·9
Johannesburg	66·5	21	25·7	24	59·6	41·5	35·1	63	124·8	21·2	·00	0	0·9
Mauritius	79·1	12	53·5	30	76·4	62·1	59·8	75	138·0	46·4	1·80	16	6·3
Calcutta	100·2	2	74·7	7	93·2	79·1	77·8	80	158·7	72·1	6·38	9	7·4
Bombay	93·2	6	75·2	13	87·8	79·0	77·1	82	138·8	73·9	13·20	22	7·8
Madras	106·1	2	75·8	14	97·3	80·8	73·9	69	149·5	74·5	2·40	6	6·4
Kodaikanal	74·6		50·7	16	65·6	53·8	51·5	77	145·6	39·2	2·06	16	7·8
Colombo, Ceylon	88·2	2,3,5	73·4	22	86·7	78·2	74·0	80	149·0	72·8	3·66	18	6·7
Hongkong	90·6	20	74·2	2	87·2	78·9	75·4	79	145·6	...	5·90	16	6·5
Melbourne	69·0	2	33·7	11	59·6	46·7	45·1	78	118·7	28·0	1·51	10	6·3
Adelaide	70·2	2	44·5	11	62·7	50·1	48·7	78	122·1	37·1	5·18	16	6·5
Coolgardie	75·9	13	36·0	17	63·6	44·6	42·8	66	136·8	29·9	1·31	6	4·4
Sydney	68·9	19	43·1	25	62·4	49·5	45·5	79	102·4	31·9	1·83	25	4·2
Wellington	58·5	6	34·5	26	54·2	44·0	42·7	78	101·0	25·0	2·42	12	5·2
Auckland	63·0	8	39·0	11	56·7	47·1	44·9	80	112·0	32·0	1·54	11	5·7
Jamaica, Negril Point	89·7	23	70·4	30	86·0	74·3	74·5	82	...	...	8·24	12	...
Trinidad	...	...	...	...	...	...	...	...	...	...	...	...	...
Grenada	86·0	1	70·0	22	83·1	73·8	71·2	81	143·0	...	12·90	29	5·2
Toronto	91·0	29	42·2	12	...	...	...	...	...	...	3·80	16	6·0
Fredericton	88·7	19	33·5	12	...	...	...	55	...	...	2·53	10	4·0
Winnipeg	84·8	14	42·2	4	...	...	...	72	...	...	6·30	13	6·0
Victoria, B.C.	77·5	24	42·4	14	...	...	...	...	...	...	·65	14	5·0
Dawson	...	...	...	...	...	...	...	...	...	...	...	...	...

MALTA.—Mean temp. of air 71°·0, or 0°·6 below the average. Mean hourly velocity of wind 9·2 miles, or 0·5 above average. Mean temp. of sea 70°·9.

LAGOS.—On the 26th, 8·30 in. of R fell.

Mauritius.—Mean temp. of air 0°·3, dew point 1°·3, relative humidity 2 per cent., and R ·26 in. below, averages. Mean hourly velocity of wind 9·4 miles.

KODAIKANAL.—Bright sunshine 90 hours. Much cloud and R below average.

COLOMBO.—Mean temp. of air 81°·9, or 0°·8 above, of dew point 0°·1 below, and R 4·39 in. below, averages. Mean hourly velocity of wind 9·7 miles.

HONGKONG.—Mean temp. of air 82°·4. Bright sunshine 246·5 hours or 95·3 hours above, and R 10·9 in. below, averages. Mean hourly velocity of wind 10·3 miles.

Adelaide.—Mean temp. of air 56°·4, or 3°·0 above, and R 2·22 in. above, average. Only one wetter June in the 50 years, viz., 6·02 in 1887.

Sydney.—Mean temp. of air 1°·6 above, and R 3·51 in. below, averages.

Wellington.—Mean temp. of air 0°·4 below, and R 2·65 in. below, averages.

Auckland.—Mean temp. of air 2°·0 below, R one-third of the average and the lowest rainfall for June except 1890.

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BRIGHT SUNSHINE IN 1906.

By R. H. Curtis.

From a meteorological point of view, the year which has recently closed was a remarkable one in more than one respect, and not least so in regard to the amount of sunshine with which we were favoured; and an account of the distribution of this element of our climate during the year may not be without interest. But in attempting this task we meet with an initial difficulty in the comparatively small amount of instrumental data available for the purpose, and in the unequal apportionment of the data we do possess to different portions of the country. Although a sunshine recorder is now getting to be regarded as a necessary item in the equipment of a meteorological station, there is still a large number of observers who do not possess one, and in consequence there are quite large areas of the country which, so far as their sunshine capabilities are concerned, are wholly unrepresented.

In some districts, however, sunshine recorders are fairly numerous, and for such regions the distribution of bright sunshine can be summarised with considerable accuracy; but for the less favoured, though probably not less important, districts, where the instruments are few and widely apart, the deductions drawn from the available data can only be regarded as more or less close approximations to the truth.

For the present brief discussion of the sunshine of 1906 the data employed have been derived from one hundred recorders of the Campbell-Stokes (burning) pattern, distributed over the British Isles from the Orkneys to the Channel Islands, and from the coast of Norfolk to that of Kerry. The number is obviously too small to represent fully so large an area, but it is, I believe, the largest which has hitherto been available for any similar purpose.

The data have been dealt with in two ways—one being to use the number of hours of bright sunshine actually registered, and the other to take into consideration the possibilities of the station, as regards its geographical position and the season of the year, and then express the number of hours recorded as a percentage of the total number

possible, supposing the sun to shine without interruption from sunrise to sunset; purely local conditions by which the horizon of the recorder may have been curtailed have not been taken into consideration.

Dealing first with the aggregate number of hours recorded in the year, the distribution—not the actual number—over the kingdom followed pretty closely that of an average year, the largest totals being found at the coast stations, and the *isohels*, or lines of equal duration, showing a marked tendency to follow the trend of the coast, as indicated on the accompanying map. The most favoured region was the English Channel and its junction with the North Sea, 2000 hours being approximately the amount recorded at every station along the coast from Torquay to Lowestoft. Inland the amount became less, but still the whole of the region south of a line drawn from the Humber to the Bristol Channel received, broadly speaking, over 200 hours more than its average yearly amount of sunshine. The smallest aggregate was that received by the north-western portion of Scotland, where it fell below 1200 hours, an amount which does not differ greatly from the average for that region. Regarding the results for the year in another way, there were 22 weeks in which the south of England was favoured with more than the average duration of sunshine; as many in which the amount was normal; and only 8 weeks in which there was a deficiency. Over the north-eastern portion of England, which also was a very sunny region last year, there were no fewer than 27 weeks with more than average sunshine, and only 9 with less than the average; while the north of Scotland had only 15 weeks which were relatively sunny.

Coming now to the individual months; the two which were least sunny, relatively to their possible amounts, were *May* and *November*, in both of which months the total number of hours recorded was nearly everywhere considerably below the average. These months, however, were exceptional, and in no other month was there such a general falling off in the records. The most brilliant months were—*February*, when many places, especially those in the north, received nearly 40 per cent. of their possible amounts; *April*, when the average amount was exceeded everywhere, the percentage of the possible amount rising at Falmouth to 66, whilst the recorded totals exceeded 250 hours at many places; and *June*, *July* and *September*, which were also exceptionally sunny months, especially the last named, when not only were the totals relatively larger, but the average amounts were also more generally exceeded than in the two earlier months. During the remaining five months of the year the departures from the averages were less regular, but in each case the southern and south-eastern districts were again well off for sunshine, whilst the north-western and south-western districts, as well as the more northern and western, received only a little above, and sometimes indeed considerably below, their average amounts.

Our space will not admit of much being said as to the correlation

of the amount of sunshine with the other meteorological factors of our climate. Of course the sunshine results are primarily related to the system of wind circulation which prevailed and brought with it, especially to the southern half of the kingdom, the clear skies which made the bright sunshine possible; in their turn the winds were controlled by the prevailing types of pressure distribution. In the two months of low sunshine records the pressure was lower than the average, and the weather was disturbed and unsettled, numerous depressions passing over or near our Islands. High pressure accompanied the fine weather of April, June and September, with their large records of sunshine; and nearly normal pressure conditions prevailed in the other months of the year, but with occasional spells of anticyclonic weather accompanied by light winds and less than the usual amount of cloud.

THE RAINFALL OF 1906.

METEOROLOGICALLY, the outstanding feature of 1906 was the remarkable abundance of sunshine; the rainfall was on the whole of little interest, though many of the details are deserving of the study which in due time they will receive. The concluding columns of the Rainfall Table on p. 241, summarise the rainfall of the year as compared with the 30 years' average used in these pages. The limited number of stations dealt with in the Table prevents us from speaking definitely as to the wetness of the year at so early a date, but the provisional deductions are confirmed by a necessarily incomplete comparison with the very large number of returns already sent in for *British Rainfall, 1906*. If the average rainfall in each case is taken as 100, the general rainfall for England and Wales in 1906 comes out as 100, or exactly the average; that for Scotland as 109, or 9 per cent. above the average; and that for Ireland 96, or 4 per cent. below the average. Viewing the British Isles as a whole, the figure is 101, or an excess of 1 per cent., so that we cannot be far wrong in speaking of 1906 as an average year with respect to the total amount of rain. The driest station which has so far been observed is Ross in Herefordshire, with a deficiency of 25 per cent.; the wettest is Dunrobin in Sutherland, with an excess of 31 per cent. Very few stations showed such great extremes, and the general distribution of rain over the country may be described as follows:—

A dry belt stretched across the centre of England from the East Riding of Yorkshire to South Devon, and a branch from it extended eastward down the Thames valley into Kent. A small patch on the north-west coast of England, and another round the Firth of Tay, were also dry, and the whole of Ireland, except the west and north-west. The only district in Great Britain, however, in which there was anything like a serious deficiency, was a narrow strip running from South Devon to near Derby, and including the middle valley of the

Severn. Here the rainfall was less than 90 per cent. of the average, and at Ross it was only 75 per cent. A deficiency of more than 10 per cent. prevailed over the south-east of Ireland.

The regions with excessive rainfall, exceeding 10 per cent., included a patch in the east of Norfolk, another in the extreme north of Scotland, where Dunrobin had an excess of 31 per cent., and a long narrow area in the centre of Great Britain, including the Pennine range in eastern Lancashire, and the west of the West Riding of Yorkshire, and extending north-westward across the Southern Uplands of Scotland and the Firth of Clyde to the shores of the Firth of Lorne. In the west and north of Ireland small wet patches also occurred.

Had the sequence of two dry years followed by a wet year held good, as it did for the previous fifteen years, 1906 should have been wet. The more detailed discussion of the data which will appear in *British Rainfall* may possibly show that the general rainfall of the country was decidedly above the average, but at present we must suspend our opinion on the matter.

THE CHRISTMAS SNOWSTORMS OF 1906.

In view of the widespread nature of the snowstorms which formed so marked a feature of the past Christmas, and which occupied so largely the attention of the Press during the holiday season, opportunity was taken of asking the whole of the observers of the British Rainfall Organization to supply information as to their character in their individual localities. The liberal response with which this request was met has had the effect of embarrassing us, for the time at least, with a somewhat unmanageable mass of raw material, rich in promise for future investigation, but from which it is difficult at so short notice to extract more than a few generalities.

As early as December 23rd the prevailing high atmospheric pressure over the British Isles began to give way, and by the following day a brisk fall of the barometer was taking place over the north of Scotland. On the evening of the same day a well-defined cyclonic system located itself over the south of Norway, and subsequently increased greatly in depth and gradient. The temperature, which had risen slightly on the 24th, now fell almost everywhere, and frosts were recorded on the 25th and 26th in most parts of Great Britain. On the evening of the 25th a secondary depression became evident over the north-west of Ireland, and later another large system formed with its centre over the Strait of Dover. The conditions were thus favourable for cold north-westerly winds, of considerable force over the North Sea, and decreasing to the westward.

Snow began to fall generally during the evening of the 25th, or early morning of 26th, and in England the greater part was deposited during this night. In some parts of our Islands, however, heavy

falls took place during the following four days, and for the present purpose it is found expedient to discuss the total depth from 26th to 30th as a whole.

During this period the whole of the British Isles, with some trifling exceptions in south Dorset and on the coasts of the Bristol Channel, was visited with snowfalls of more or less severity. Indeed, the districts in which less than an inch fell were almost negligible, being confined to south-east Wales, part of Wessex, some places in the south and east of Ireland, and also a tract between Edinburgh and Glasgow. Considerably more than half the Kingdom received a fall greater than five inches in depth, the most important exceptions being the whole of England south-west of an irregular line crossing the country from the Solway Firth to Brighton, except some patches in the upper Thames Valley. A somewhat lighter fall also took place in south-east Yorkshire, Bedfordshire, and parts of Essex. The north and central uplands of Wales probably exceeded the five-inch limit, although insufficient data make it unsafe to speak definitely of the remoter districts of the Principality. In East Anglia a large and fairly well-defined area, including most of the south of Norfolk and the north of Suffolk, lay under snow exceeding ten inches in depth, and as much as fourteen inches was reported from Wymondham. More than ten inches fell over the northern extremity of the Chilterns, but this was confined to a quite small area. Between Lincoln and Newark also, nearly a foot undoubtedly fell. The part of England, however, which suffered most severely was a strip including the more elevated portions of the county of Durham, and stretching along the east coast of Northumberland into the southern uplands of Scotland. Eighteen inches fell near Morpeth, and probably about a foot over the upper valleys of the Tees and Wear. About the same amount is reported from Berwickshire and Peebleshire. The basins of the Clyde and Forth, together with large tracts in southern Perthshire and Argyll, escaped comparatively lightly, but to the north of this there seems to have fallen almost everywhere a covering of a foot in depth, reaching upwards of two feet in Kincardine and probably also in southern Aberdeenshire. A strip with less than five inches however occurred round the shores of the Moray Firth.

Although the greatest depth recorded was undoubtedly in Scotland, the extent and severity of the storm in Ireland was certainly more noteworthy owing to the usual immunity of the Emerald Isle from heavy snowfalls. More scattered information than exists for Great Britain render positive assertions unsafe, but as far as the data can be relied upon to represent the facts, the whole island north of the latitude of Dublin, apart from the sea borders, received above five inches, an instance of widespread deep snow probably almost unique for Ireland. More than a foot is also reported from several stations in the north and west, and it seems probable that this amount fell over large districts. It is interesting to note the

coincidence of the most affected part of Ireland, with the small secondary barometric depression which formed in this locality, and during the influence of which the greater part of the fall seems to have taken place.

The severity of the storm occasioned much suffering in many localities. Numerous deaths from exposure have been reported; trains were snowed up in the south of Scotland, and for three days Aberdeen was isolated by blocked railways and broken telegraph wires. The most serious disaster was a railway collision near Arbroath, attended by much loss of life.

ATMOSPHERIC PHENOMENA DURING THE CHILE EARTHQUAKE.

By William Gaw, Santiago.

In view of the interest occasioned by the terrible earthquake which visited the central part of Chile on August 16th, I bring forward some data relative to the atmospheric phenomena observed in Santiago just before and after the seismic movements. I may here advert to the fact that the Meteorological Section of the Chilian Navy in Valparaiso, about seven days previous to the catastrophe, prognosticated some atmospheric or seismic disturbances for that day in the following terms, translated from the local newspapers:—

The Meteorological Section of the Direction of Marine Territory has prognosticated atmospheric or seismic phenomena for the 16th of the present month, based on the following observations:—

On the said day there will be a conjunction of Jupiter with the Moon and maximum of northerly declination of the Moon. Owing to these positions of the planets the circumference of the dangerous circle passes Valparaiso.

The above prediction naturally arrested my attention, although I confess I was rather sceptical as to any seismic disturbances being produced by the conjunction of Jupiter with the Moon. The forecast was virtually ignored by the general public, who take little or no interest in atmospheric phenomena, the only living interest taken in these matters being found amongst the officers and officials of the Chilian Navy.

Santiago Observatory is situated in latitude 33° 26′ 42″ South, longitude 70° 41′ 36″ West of Greenwich, at an altitude of 1706 feet above sea level. The mean annual barometric pressure for Santiago is 28·23 inches.

The following table is issued by the Astronomical Observatory as an approximate guide for weather forecasts in Santiago:—

	inches.
Good weather fixed	28·60
Good weather	28·41
Variable	28·23
Rain	28·05
Storm	27·87
Hurricane	27·70

The comparatively small range between the minimum (27·70 in.) and the maximum (28·60 in.) of the barometric fluctuations is worthy of remark, but, as is well known, the oscillations in high latitudes are much greater than those near the tropics. The greatest monthly variation recorded since 1860 was ·60 in., in June, 1903. A monthly variation of ·44 in. is abnormal and very rare. The *total* variation since 1860 has been ·90 in. (August, 1865, 28·67 in., and June, 1905, 27·77 in.)

Bearing in mind the forecast for August 16th, we carefully watched the movements of the barometer, hygrometer and thermometer, with the object of detecting anything which might indicate the fulfilment of the prediction issued by the Meteorological Office in Valparaiso. The first sign of anything unusual was on the evening of the 11th, at 9 p.m., when rain began to fall and continued during the following day up to 4 p.m. The amount of rain during these 19 hours was 1·97 in. The prevailing wind was from the N., with a maximum velocity of 30 miles per hour. On the 12th nothing in the weather attracted attention. On the 13th we had a S.W. wind blowing all day, accompanied by a very high barometer. The following are the readings for that day and the days following :—

1906.	AUG. 13.		AUG. 14.		AUG. 15.		AUG. 17.	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Temp. (shade).	41°·2	48°·0	32°·9	48°·6	44°·1	52°·9	45°·3	57°·4
,, (exposed).	41°·0	59°·0	28°·4	47°·3	30°·2	54°·5	44°·2	79°·7
Bar. (inches)...	28·30	28·52	28·40	28·52	28·08	28·38	28·36	28·37
Rel. Humidity	76%	95%	52%	99%	84%	97%	65%	95%

Notwithstanding the conditions on the 13th, we had that day heavy showers of rain. This infrequent phenomenon courted special mention in the readings issued by the Astronomical Observatory in Santiago. A similar phenomenon was observed on the 14th—*i.e.*, high barometer accompanied with rain.

A decided change in the barometric pressure took place on the 15th, as shown in the foregoing table. There was a very pronounced drop of the barometer within 24 hours, something very unusual for Santiago. On the 16th, Valparaiso, Santiago and surrounding districts were visited by a terrible earthquake, causing enormous loss of life and property in the former city. As no meteorological readings for the 16th were published I am unable to furnish figures. The first shock came at 7 h. 58 m. 44 s. p.m., without any previous warning, and continued till 8 h. 3 m. 34 s. ; direction N. to S., duration 4 m. 50 s. This was immediately followed by another shock at 8 h. 7 m. 30 s. with 20 minutes' duration. The latter shock was the severest and most destructive of all. Up to 5 a.m. the following day we experienced 23 shocks at different intervals. Copious rain fell for some hours before the first shock and continued until about 10 p.m. At the time of writing (October 20th) 106 shocks have been recorded by the seismograph in Santiago. At the moment of the catastrophe the heavens presented a most unnatural hue.

Electrical discharges were numerous, and it seemed as if the sober laws of physics had revolted. The writer cannot recall with precision the exact atmospheric conditions prevailing at the moment of the great disturbance, though he has more than a vivid recollection of that never-to-be-forgotten night. On the 17th, as shown in the Table, the atmospheric conditions appeared to be more or less normal once more. The subsequent readings showed nothing unusual except that they were marked by high barometric pressure until the 21st.

From the data brought forward we deduce the following :—

(1) The third and second days previous to the great shocks were characterised by a high barometer accompanied with rain—abnormal conditions here. (2) The day preceding the first seismic movement (15th) was marked by a sudden fall of about half-an-inch of barometric pressure in a comparatively short period of time.

The cause and import of such a fluctuation is perhaps difficult to determine, but the writer is of opinion that there was some relation between the earthquake of the 16th and the atmospheric phenomena observed before and after it. He is also convinced that there is interesting and instructive information to be acquired by carefully observing all atmospheric phenomena that precede seismic movements all over the globe. That there is *some* relation between atmospheric perturbations and seismic tremors few will deny ; and it may not be too much to anticipate that in future observers in meteorology will play their part in contributing data that will help to determine the genesis of seismic phenomena. Until we possess a more perfect knowledge of the physical conditions existing a few miles beneath the Earth's crust we should be content to be tentative and not dogmatic in our assertions. Statements emanating from such authorities as Professor J. Milne and the Hon. R. J. Strutt are pregnant with deep import and open up unlimited fields of research to the intelligent observer.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held at the Institution of Civil Engineers, Great George Street, Westminster, on Wednesday evening, December 19th, Mr. Richard Bentley, President, in the chair.

Admiral J. P. Maclear read a paper on "The Guildford Storm of August 2nd, 1906." This storm showed some very curious and interesting features, in the remarkable violence of the wind, rain and hail, within a small area, and the suddenness with which it burst. There was an area of thunderstorms over the whole of the south of England on the evening of that day. The most violent storm, however, burst over Grayshott on Hindhead at 8.20 p.m., and pursued a narrow track through Godalming and Guildford to

Ripley, five miles north-east of Guildford. The wind was of hurricane force, and blew down an immense number of trees and caused other damage and also the loss of two lives. The rain, accompanied by large hailstones, was very heavy, as much as 1·17 in. falling at Grayshott in 15 minutes. There was a magnificent display of lightning, the flashes being incessant and darting from cloud to cloud. The observer at Charterhouse School, Godalming, gave the following interesting account, which shows the intense character of the storm:—

"At about 8.35 a few splotches of rain, a roar of the whirlwind, and then such hail and rain as I had never witnessed before, and trust may never again; the noise was deafening, as though hundreds of loads of gravel were being shot from on high against the window panes, while all the while the thunder bellowed and crashed overhead. My front door was open when the tornado burst, and I had great difficulty in shutting it; but even in those few moments my hall was flooded, curtains, mats and rugs blown upstairs, and a bucketful of hailstones, as large as sparrow's eggs, deposited at the foot of the stairs.

"In about eight minutes it was all over: the sky resumed its tranquil aspect as though nothing had happened, and the storm rolled quickly away to the north-east. The barograph in the library showed at the onset of the storm, at 8.35, a jump of $\frac{1}{5}$ of an inch, and immediately a fall of $\frac{3}{20}$, then gave a slight 'kick' and a steady rise. The rainfall during the eight minutes was ·77 in., though there was probably rather more, as hailstones often jump out of the funnel of the rain gauge.

"The region of maximum violence in our neighbourhood was undoubtedly from Hurtmore Bottom to Guildford. The breadth of the disturbance was about 2 miles; its north-west boundary lay between Priors Field and Puttenham, probably nearer the former, for Shackleford escaped serious damage."

An interesting discussion followed the reading of this paper. Dr. Theodore Williams referred to the damage done to the trees in his immediate neighbourhood at Witley.

Mr. W. H. Dines said that the storm seemed to have taken a track a little north of the railway from Guildford to Surbiton, ending in the neighbourhood of Oxshott.

Mr. W. Marriott showed some photographs of lightning taken during the storm, and stated that it was reported that in London there were over 600 flashes in 52 minutes. He also referred to the severe hailstorm which occurred on the same evening on the borders of Bedfordshire, Cambridgeshire and Huntingdonshire, where considerable damage was done. He thought that the jump in the barograph trace was largely due to the compression of the air caused by the sudden heavy rainfall.

Mr. R. G. K. Lampfert enquired whether the trees were all blown down the same way. He also stated that he had collected a large

number of records for that day from all parts of the country, but had not been able to get any satisfactory results from them.

Prof. A. S. Herschell described an effect of the lightning on the same evening in the north of England. A large hole was made, and the sod was hurled a distance of 25 yards.

Dr. W. N. Shaw, Mr. F. C. Bayard, Mr. T. P. Newman, Mr. W. B. Tripp, Capt. A. Carpenter, and the President also spoke, and Admiral Maclear replied.

The following were elected Fellows of the Society :—Mr. R. M. Balston, Capt. K. E. Digby, Major G. R. Elliot, Major G. E. Galbraith, Capt. A. A. C. Galloway, Capt. C. G. Manners, Mrs. H. R. Mill, Mr. R. Mond, Major C. Peters, Mr. H. Reid, M.Inst.C.E., Capt. E. J. W. Slade and Mr. W. Wilson.

LIGHTNING CONDUCTORS.

On December 6th, Mr. Alfred Hands delivered a lecture before the Royal Engineers at Chatham, on "The Protection of Buildings from Lightning." He showed the extent of damage by lightning by means of a chart of England and Wales, on which the positions and nature of objects damaged during a period of about nine years were indicated by coloured spots. This included 2,485 buildings, of which 148 were churches. He criticised the Report of the Lightning Research Committee, which, he said, by its contradictory recommendations and incorrect statistics, had caused a great deal of scepticism as to the utility of lightning conductors. He showed by diagrams and reproductions on models of buildings of cases that had occurred, some of the more complex lightning effects that had to be guarded against, and the methods of protection that had to be employed. These included fires caused by the surging effect of a discharge, and cases in which damage is caused to a building by lightning striking an object half a mile away.

The lecturer showed the impossibility of protecting buildings efficiently by means of set rules; each case had to be studied separately, and the system of protection applied which the complications of metal in and about the structure showed to be necessary. Hitherto too much importance had been attached to the form and composition of the conductor, and too little to the fact that its efficiency depended almost entirely on the way in which it was applied, and very little on what it was. He regarded the subject as somewhat analogous to the work of a medical practitioner. The conductors in the hands of an expert were comparable to the drugs a physician might find it neccessary to prescribe according to his diagnosis of the case. No one could claim infallibility, and anyone might overlook some factor that might have an important bearing on the case; but the fact remained that the possession of knowledge, experience, and an ability to discriminate as to the importance of details should enable a man

to protect a building effectively, while absence of these would very probably result in failure. At all events, it was in this direction he thought we should strive to improve our methods, and not in trying to devise theoretically perfect, but practically impossible mechanical arrangements.

As regards the relative value of iron and copper for conductors, he considered the matter so far as concerned conductivity and the dissipation of energy, to be of such trifling importance that it sank into insignificance in comparison with considerations of durability. A lightning conductor was expected to last for a long time, and iron was, unfortunately, too perishable for the purpose. As regards cost, an iron system, if of sufficient size to be fairly lasting, would be more costly than an ordinary copper tape one.

Mr. Hands said that vagaries or freaks of lightning were an impossibility, and the belief in such was due only to the cases being wrongly reported. There were laws governing all natural phenomena, and lightning, like every other force in Nature, must be amenable to law. Where they appeared at first sight inexplicable, we should try to clear up the mystery, and not dismiss the matter by saying that in one respect Nature was erratic.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

AUDIBLE METEORS.

THERE is no need for you to apologise for having placed a ? after the title of Mr. Huntley's letter on p. 190 of the November number; he himself evidently considers that any connection between the sound and the meteor is doubtful, and he may well do so. Mr. Wood, on the other hand, sees no difficulty in the connection, and cites several instances to show that meteors emit sound. There is no doubt they do, but I would point out that these cases do not explain Mr. Huntley's observation.

In the instances of the great Madrid meteor and the meteor of January 25th, 1894, 10 p.m., a distinct time interval between the flash and the detonation was recorded, in no case probably less than one minute.

In the instance of January 9th, 1900, there is no mention of what the time interval was. In the instance of November 20th, 1887, the meteor was seen only at Hertford, and it is expressly stated that no report was heard there. All other observations deal with the sound only, and therefore no time interval could be recorded.

But in Mr. Huntley's case he heard the sound *before* he saw the meteor. I would ask Mr. Wood how he explains this, except on the supposition that the velocity of the meteor was less than that of

sound; and, if so, how at such a velocity could the meteor be incandescent?

Many instances of similar observations have been recorded. The only probable explanation is that the observer, startled by the suddenness of the phenomenon, unconsciously attributes to the meteor the hissing sound with which in the case of a rocket he is doubtless quite familiar.

In Vol. XIII., p. 277 of the *British Astronomical Association Journal*, there is a most interesting letter from Mr. Denning on this subject. No one knows more about meteoric astronomy than he does, and with your permission I append a few extracts:—

"I have seen some thousands of meteors of various magnitudes and kinds, but never in a single instance detected any hissing or rushing sound attending an object."

"The attention of an observer at Faringdon, Berks, was attracted by a distant hissing sound, and looking up he saw the meteor. Another observer at Bath distinctly heard a slight continued hissing. The observer in Berks was 150 miles distant from the meteor."

"A number of the observers, who have confidently affirmed that sounds were audible simultaneously with meteoric outbursts, were distant 100 or 150 miles from the objects, whereas other observers much nearer to them say that the flights were absolutely silent."

The only case (quoted in the same letter) of an experienced observer hearing a sound is that of Lieut.-Col. Tupman, who, when at anchor in the River Plate, "saw a shooting star of the first magnitude traverse some 40° of the sky, and less than a second after heard a gentle hissing sound from its direction, which greatly astonished him." Mr. Denning then adds: "He merely reported the observation as a curious incident, without attaching undue importance to it." CHARLES L. BROOK.

Harewood Lodge, Meltham, Dec. 27th, 1906.

THE SUNSPOT QUESTION.

ACCORDING to a review in your November issue, Prof. Bigelow represents that when the sun is most active, and spotted, temperature is relatively high in the tropics and low in temperate regions. As this appears to be in conflict with facts established by Köppen and Nordmann for the tropics, and with our own experience in these parts (Greenwich), some explanation will be acceptable. A.B.M.

8, Marine Crescent, Folkestone, 7th Dec., 1906.

THAT'S WHY.

HEREWITH I enclose answers to the two questions on page 211 of *Symons's Meteorological Magazine*, which are puzzlers to answer concisely. P. P. PENNANT.

Nantlys, St. Asaph, 26th Dec., 1906.

Why do rain-drops differ so much in size?

Rain-drops are formed in cooling air. At first extremely small, they touch each other, coalesce, and become larger. Large drops fall faster than small, hence, incessant collisions, producing larger drops. So falling from a great height rain-drops may be large, but formed near the Earth must be small. P.P.P.

Why is the distant view . . . . so remarkably clear before rain?

Because the air we look through has already been washed with rain, or is so nearly ready to form rain that it has moistened the dust and smoke in the air, making them too heavy to float in the air any longer, and produce haze. P.P.P.

[Several answers have been received; but the neatest appears to be the above.—ED. *S.M.M.*]

NATURE'S REVEILLÉE.

A CURIOUS phenomenon reported to me many years ago by a cousin who had a large horse ranch in Colorado, U.S.A., has recently received such satisfactory confirmation through the 7 in. chart of the latest barograph, that I think it worth mentioning to your readers. The phenomenon in question is that Nature causes a curious trembling or shiver of the air over the enormous American plains an hour or so before sunrise, which acts as a *reveillée* call for all the animals, birds and insects to be on duty for the rising sun. This would appear to be a very beautiful provision of Nature, and although we, with our heavy dock traffic, cannot say whether there is a tremor in the air attributable or not to the atmosphere, the new 7 in. barograph shows that there is a small V-shaped depression occurring each morning about 90 minutes before sunrise—a sort of *reveillée* dip, in fact—the extra 30 minutes being due probably to our more northern situation.

If those possessing these new instruments will kindly direct their attention to this question they may be able to favour us with some valuable data. J. H. W. BIGGS.

Liverpool, November 20th, 1906.

[The regular diurnal variation in atmospheric pressure in and near the tropics is so persistent that it is not unreasonable to suppose that at the period of temperature minimum shortly before the dawn some slight air movement may occur every morning; but we doubt whether any such occurrence could be traced amidst the irregular changes in the unstable atmospheric equilibrium of our latitudes. We should require a much more definite statement than Mr. Biggs supplies before accepting the existence of so highly improbable a phenomenon.—ED. *S.M.M.*]

THE GREEN FLASH.

As the discussion of this phenomenon has excited considerable interest of late, I am sending you particulars of its appearance in, so far as I know, exceptional circumstances. On the 23rd of December, when using a pair of opera glasses, I watched the sun setting into a low and narrow cloud stretching along the south-western horizon. The cloud was scarcely apparent to the naked eye, but plainly visible through the glasses, whilst the whole of the disc was visible, and just as the bottom edge touched the cloud, there was a beautiful green lining along the top edge, deeper at the middle than at the two extremities. This slowly diminished until it disappeared. After a few seconds it re-appeared, but not so strongly as before, and again diminished to nothing when the sun's disc was about two-thirds hidden, and was not seen again. The sun was redder at the bottom than at the top, and I saw no prismatic colours.

Does not this point to the green flash being produced through a peculiar condition of the atmosphere favouring its appearance rather than from some of the causes which have been adduced to account for it?

I may mention that I have seen both a green and blue flash on several mornings during this month through a three-inch refractor when the sun has risen out of a bank of clouds stretching along the sea horizon. The appearance, however, was not in the nature of a flash (except in its rather sudden disappearance), as I watched it on each occasion for several seconds as the green or blue colour travelled along the opposite edges of the cloud as more and more of the sun's disc became visible. The eye-piece was a magnifier of about 60 diameters, and the image of the cloud and arc of the sun's disc were, of course, inverted. WILSON LLOYD FOX.

Falmouth, 26th December, 1906.

SINCE you published Admiral Maclear's letter about a year ago (*Symons's Meteorological Magazine*, January, 1906, p. 227) on the subject of the green flash, your correspondents have, it seems to me, described four or five different phenomena under this name.

1. In order to see a striking phenomenon, which may be described as a green flash, the observer has only to look for a second or so at the red disc of the rising or setting sun, and then to alter slightly the direction of his eyes, and he will immediately see a visionary image or spectrum of the sun in the complementary green colour. If the disc of the sun happens to be coloured orange, the visionary image will be blue. This is an example of ordinary successive contrast, and is a physiological phenomenon. There is no reason why it should not be just as well seen at sunrise as at sunset.

Last summer there were some beds of calceolarias in the flower

garden under my bedroom window. On getting up in the morning and opening the shutters I could hardly avoid looking on one or another of these beds. My eyes, after sleep, being thoroughly rested, and therefore susceptible, a momentary glance at the flowers was sufficient to stimulate my eyes, as soon as their direction was slightly altered, to produce visionary images of the flowers in the complementary blue colour. They were seen as blue spots on the turf near the flowers, lasted about a second, and might be described as "blue flashes."

I may add here that I do not consider their appearance to be due to "fatigue" of the eye, but to its vital elasticity, which produces out of itself the colour or colours necessary to complete the triad of leading colours. Thus the green demanded by red contains yellow and blue; orange, uniting yellow and red, demands blue; and the violet demanded by yellow contains red and blue.

2. I have not myself witnessed the green flash described by Admiral Maclear and other observers as seen when the sun is rising above or sinking below a sea horizon in a clear sky.

When the sun at rising or setting is coloured red or orange, this green flash may be an example of the physiological phenomenon of colour described above. Or it may be a phenomenon produced by coloured shadows. Coloured shadows are seen when there are two lights in the atmosphere, one coloured and the other uncoloured.

The shadow cast by the coloured light (in this case red) and illumined by the uncoloured one, would exhibit the complementary colour (in this case green).

The phenomena of coloured shadows, although belonging to the physiological colours, have more objective reality than the previously described examples of physiological contrast. Again, it is possible that this example of the green flash may be produced by the intermixture of a yellow ray of the rising or setting sun with the blue of the sky.

As the green flash is seen when the sun is rising above or setting below the edge of the horizon, it may be produced by *refraction*, or by *diffraction*, or by both combined. If produced in this way, the stripes of colour accompanying the refraction or diffraction may, when pressed together just before their disappearance, produce a greenish-blue or a red colour, which may be described as a greenish-blue or as a red flash.

In the first two cases the phenomena would be examples of physiological colours; in the last two, of physical colours.

3. The phenomena described in the latter part of Prof. Michie Smith's letter in *Symons's Meteorological Magazine*, June, 1906, p. 91. appear to be examples of physiological colours due to contrast.

They are examples of *simultaneous* contrast, while the phenomenon first described is due to *successive* contrast.

In the first case, the upper part of the sun's disc, when it was setting, and when its light was probably subdued by haze or mist,

was coloured green, because the reddish light reflected by the clouds evoked the complementary green colour. In the second case, the green mist which filled the whole sky at sunset, was probably due to the same cause.

The green colour in both cases was the complementary colour of the reddish light reflected by the clouds, and was an example of *simultaneous* contrast.

If a piece of white paper is placed on a red surface, the white paper will be tinged with a green hue.

4. The phenomenon seen through a telescope, and described by Dr. Rambaut (*Symons's Meteorological Magazine*, March, 1906, pp. 21-23, and April, 1906, pp. 41-45), and by Mr. Whitmell (December, 1906, pp. 209–210), are, of course, examples of the colours which accompany refraction.

Mr. Whitmell describes how the yellow border at the base of the sun widens out, and meeting the blue edge at the top of the disc, produces green. This green he calls a green flash.

5. In the observations described by Mr. Whitmell, and quoted by Dr. Rambaut as seen through the narrow openings in a belfry; in the observations described by Dr. Rambaut as seen through a telescope, in which an opaque diaphragm, or a diaphragm with a narrow slit, had been placed: and in the observations described by Mr. Whitmell (December, 1906, p. 209), when "the sun was sinking behind a low horizontal narrow bank of cloud, between which and the horizon was a strip of clear sky," the colours seen are due to refraction and diffraction.

I have tried to separate the different phenomena, which have been described under the name of the "green flash," into different classes, according to the conditions under which they are produced.

Some of the phenomena are due to *successive* contrast, some to *simultaneous* contrast, some may be examples of the phenomena produced by *coloured shadows*.

Others, again, are examples of the colours which accompany *refraction* only, or both *refraction* and *diffraction*.

Again, a green flash might be produced by the admixture of a yellow ray of the rising or setting sun with the blue of the sky.

The three first cases belong to the class of the physiological colours; the three last to that of the physical colours.

Admiral Maclear remarks (January, 1906, p. 227) that different "writers appear to hold different views as to the cause" of the "green flash." The reason, as is seems to me, is that the writers are describing *different* phenomena under this name; phenomena which are produced by different conditions, and are to be traced to different causes. R. C. CANN LIPPINCOTT.

Over Court, Almondsbury, Bristol, 3rd Jan., 1907.

[Our great respect for Mr. Cann Lippincott as an earnest and enthusiastic meteorological observer, makes us desirous of showing

him every possible courtesy, and we have enlarged this number of the Magazine in order to admit his letter, which our editorial conscience feels is too long. We do not agree with his views on the question of colour, but most fully support Dr. Rambaut's able and convincing demonstration of the phenomenon under consideration, which no correspondent, so far as we are aware, has confused with the familiar effects of complementary colours except Mr. Lippincott himself. When he sees the phenomenon which our correspondents have described he will, we believe, at once recognise its essentially distinct character. The Green Flash has illuminated our pages for a year, and we do not propose that the correspondence should continue. ED. *S.M.M.*]

REVIEWS.

The Science Year Book, with Astronomical, Physical and Chemical Tables, Summary of Progress in Science, Directory, Biographies and Diary for 1907 (third year of issue). Edited by Major B. F. S. BADEN-POWELL. London, King, Sell & Olding. Price 5s. net. Size $9\frac{1}{2} \times 6$. Pp. 152 + diary.

THIS very conveniently arranged book is particularly useful to the student of Nature who interests himself in various branches of science. The introductory matter is well planned, and every here and there one comes on little tables of a useful kind that it would not be easy to find elsewhere. The diary gives for each day the hour of the rising and setting of the sun and moon, and of such planets as are visible, a note of the constellations which are on the meridian at midnight, a memorandum of the maximum and minimum temperature for the day at Greenwich, and spaces for the meteorological observations of the day.

The Life-History of Surface-Air-Currents. A Study of the Surface Trajectories of moving air. By W. N. SHAW, Sc.D., F.R.S. (Director of the Meteorological Office) and R. G. K. LEMPFERT, M.A. Published by the Authority of the Meteorological Committee, London, 1906. Size $12\frac{1}{2} \times 10$. Pp. 108. Price 7s. 6d.

INFALLIBILITY is one of the most cherished prerogatives of an Editor, and the acknowledgment of any shortcoming is so unusual a proceeding that we only make it when fairly cornered between the Devil of accumulated literature and the Deep Sea of a new year teeming it may be with as good fish as ever came out of the old. We meant well in the way of reviews for 1906, and particularly we resolved to devote abundant space to any important contributions to Meteorology

published in Great Britain. Now we find ourselves looking helplessly at what we believe to be the most important contribution to meteorology of 1906 produced in any country, and the very importance of the work makes it at once an impossibility to give an adequate review in the space and time at our disposal, and an impertinence to offer an inadequate one.

We therefore attempt no review, but only say that the method employed in this memoir is that of tracing the actual path of the air as it takes part in a travelling storm, and the results though now seen to be in accordance with the laws of air-movements, are such as had not been anticipated before Dr. Shaw and Mr. Lempfert originated the promising method of research here laid down. We need not urge the serious student of meteorology to read the "Life-History"; he will recognise that it is essential if he wishes to keep in touch with what may be termed the "growing point" of the science.

Popular Meteorological Handbook. Some Facts about the Weather by WILLIAM MARRIOTT, F.R.Met.Soc., Assistant Secretary. London: Edward Stanford. 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 32. Price 6d.

THIS pamphlet is designed to give in a brief and popular form such fundamental facts about the weather as should help the "man in the street" to understand the references in his newspaper, and whet the interest of the amateur observer to seek fuller information elsewhere. There is no one better able than Mr. Marriott to appreciate the points regarding which information is most welcomed by the public interested in weather, nor is there a more experienced or safer guide than he in all that pertains to practical observing. The service he is rendering to his Society as a popular lecturer on various aspects of weather-lore is no small one, giving expression as it does to the experience of a lifetime spent in the Society as assistant-secretary and inspector of stations. It is to be hoped that this little book will widen the interest in the work of the Royal Meteorological Society, and be the means of introducing many to the privileges which the Society offers.

Der meteorologische Äquator im Stillen Ozean, von R. WESTERMANN. *Aus dem Archiv der Deutschen Seewarte.* **29** Jahrgang 1906. No. 1. Hamburg, 1906.

THIS paper discusses the position of the meteorological equator in the Pacific Ocean with regard to such elements as temperature, humidity, wind-force, precipitation, cloudiness and pressure distribution. The meteorological equator is theoretically defined as the imaginary line which connects places along each meridian with the highest mean annual temperature, and which represents a division of

areas corresponding to an approximately symmetrical distribution of the various meteorological elements. From this line towards either side the mean air pressure and wind velocity increase, the mean cloudiness, humidity and amount of precipitation decrease, and the mean wind direction indicates the exact component due to the position of the wind along a meridian. With regard to the Pacific Ocean, some of the material under discussion has been derived from six hundred meteorological logs kept on sailing vessels, and from certain land stations mainly in the islands under German protection. The thermal equator is the bisector of a temperature belt bounded by the isotherm of 25° C., which alters its breadth and latitude according to the time of year. In the eastern half of the ocean the form of the belt is affected by the South Equatorial Current, which shifts and compresses the belt towards the north, but in the western half of the ocean its breadth is not hampered. In the summer half-year of the northern hemisphere, however, owing to its northward trend, the belt is little influenced by the South Equatorial Current. Much information in figures relating to the meteorology of the Pacific Ocean is given in tabular form in the paper under our notice. L. C. W. B.

METEOROLOGICAL NEWS AND NOTES.

PROFESSOR H. H. HILDEBRANDSSON has resigned the office of Director of the Meteorological Observatory at Upsala, and Mr. F. Aakerblom is discharging *ad interim* the duties of the Director.

THE MACHRIHANISH TOWER, the fall of which during the gale of December 5th, 1906, was described by Mr. Douglas in our last issue (p. 201), was constructed, according to a well-informed local correspondent, of lengths of steel tube which did not overlap but were rivetted together through flanges. The immediate cause of the catastrophe was the drawing of the ends of the wire cables out of the masses of soft metal in which they had been embedded, and not any defect in the material employed.

MR. W. MARRIOTT has arranged to lecture in accordance with the Royal Meteorological Society's scheme of local lectures on February 6th at the British Sea-Angler's Society, Fetter Lane, London, E.C.; on February 9th at the Ealing Scientific and Microscopical Society; on February 18th to the Glasgow Amateur Photographic Association, and on March 13th at Kendal.

THE AMIR OF AFGHANISTAN deserves to be ranked a meteorological observer. At one of the receptions in India the weather was bad, and *The Times* records that "he bore the discomfort of the weather with the greatest equanimity, remarking that rain was always considered a sign of good fortune in Afghanistan."

TEMPERATURE FOR DECEMBER, 1906.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	TEMPERATURE. Max.		TEMPERATURE. Min.		No. of Nights at or below 32° Shade.	No. of Nights at or below 32° Grass.
		° ′	° ′		°	Date.	°	Date.		
Camden Square	*London*	51 32	0 8	111	55·1	3	20·9	27	13	22
Tenterden	*Kent*	51 4	*0 41	190	54·0	3	16·0	30	19	23
West Dean	*Hampshire*	51 3	1 38	137	53·0	3, 4	19·0	24	17	25
Hartley Wintney	,,	51 18	0 53	222	55·0	3, 4	19·0	28	22	24
Hitchin	*Hertfordshire*	51 57	0 17	238	53·0	4, 5	19·0	29	21	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	55·0	4	14·0	27	22	23
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	52·0	2, 3, 4	13·5	30	...	...
Brundall	*Norfolk*	52 37	*1 26	66	...	..	...	...	...	...
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	53·9	3	24·0	24	15	20
Torquay (Cary Green)	*Devon*	50 28	3 32	12	57·1	4	28·8	28	4	11
Polapit Tamar [Launceston]	,,	50 40	4 22	315	52·9	3	24·9	29	12	17
Bath	*Somerset*	51 23	2 21	67	55·0	3	21·0	30	15	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	52·0	2	24·0	29	19	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	55·0	4	15·0	27	25	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	51·0	5	10·0	26	22	...
Boston	*Lincolnshire*	52 58	0 1	25	52·0	2	15·0	27	21	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	54·7	4	13·7	30	18	25
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	52·0	2	18·0	26, 29	20	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	52·8	2	19·7	27	19	21
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	54·0	2, 5	22·0	30	17	27
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	53·6	4	15·5	27	17	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	53·4	2	22·8	23	8	17
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	52·0	2, 4	16·0	28	...	...
Llandudno	*Carnarvon*	53 20	3 50	72	54·0	3	28·2	26	6	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	54·0	2, 17	15·0	26	18	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	51·0	2	20·0	22, 30	21	23
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	55·3	2	22·7	26	15	18
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	52·0	1, 16	16·0	28	12	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	52·0	2, 4	16·0	25	16	24
Tighnabruaich	*Argyll*	55 55	5 14	50	50·0	1	19·0	25, 28	19	20
Mull (Quinish)	,,	56 36	6 13	35	...	...	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	55·0	2	15·5	31	17	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	...	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	56·0	2	8·0	29, 30	22	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	55·0	4	18·0	31	16	...
Castletown	*Caithness*	58 35	3 23	100	52·0	2, 7, 16	11·0	31	17	19
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	57·0	18	16·5	29	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	56·5	2	22·0	29, 30	11	..
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	50·0	2†	14·0	28	11	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	55·9	5	23·1	30	6	15
Ballinasloe	*Galway*	53 20	8 15	160	...	...	...	...	...	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	52·0	1, 2, 16	20·0	29	14	17
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	53·0	2, 4, 16	18·0	28	13	16

† and 3, 4, 17.

RAINFALL FOR DECEMBER, 1906.

Nights below 32°	RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.				Mean Annual 1870-1899.	STATION.
	Aver. 1870-99.	1906.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1906.	Diff. from Aver.	% of Av.		
Grass.	in.	in.	in.		in.	Date.		in.	in.	in.		in.	
22	2·12	2·21	+ ·09	114	·34	25	19	25·16	24·27	— ·89	96	25·16	Camden Square
23	2·74	2·02	— ·72	74	·39	25	15	28·36	27·37	— ·99	97	28·36	Tenterden
25	2·74	1·91	— ·83	70	·32	15	19	29·93	29·96	+ ·03	100	29·93	West Dean
24	2·55	2·09	— ·46	82	·37	25	17	27·10	26·35	— ·75	97	27·10	Hartley Wintney
...	2·05	2·21	+ ·16	108	·35	15	18	24·66	25·44	+ ·78	103	24·66	Hitchin
23	2·27	2·20	— ·07	104	·38	15	19	26·75	25·73	—1·02	96	26·75	Addington
...	2·11	2·46	+ ·35	117	·39	25	16	25·39	27·11	+1·72	107	25·39	Westley
...	2·13	3·73	+1·60	175	1·20	25	21	25·40	29·96	+4·56	118	25·40	Brundall
...	4·13	2·68	—1·45	65	·59	30	16	39·00	39·39	+ ·39	107	39·00	Winterbourne Stpltn
20	3·46	1·53	—1·93	44	·30	12	18	35·00	28·53	—6·47	82	35·00	Torquay
11	4·39	4·55	+ ·16	104	·65	15	23	38·85	40·10	+1·25	103	38·85	Polapit Tamar
17	2·76	1·87	— ·89	68	·37	25	15	30·75	27·24	—3·51	89	30·75	Bath
...	2·48	1·50	— ·98	60	·32	15	18	29·85	26·87	—2·98	90	29·85	Stroud
...	2·92	2·25	— ·67	77	·32	5	20	33·04	29·22	—3·82	88	33·04	Woolstaston
...	1·95	1·75	— ·20	90	·40	15	13	24·50	23·24	—1·26	95	24·50	Bromsgrove
...	1·79	2·31	+ ·52	129	·64	25	15	23·30	23·71	+ ·41	102	23·30	Boston
25	2·02	2·53	+ ·51	125	·48	4	24	24·70	23·43	—1·27	95	24·70	Hodsock Priory
...	2·28	2·10	— ·18	92	·44	5	22	26·18	23·83	—2·35	91	26·18	Derby
...	4·19	5·90	+1·71	141	·61	15	24	42·43	50·54	+8·11	119	42·43	Bolton
21	2·19	2·38	+ ·19	109	·38	15	16	26·96	27·93	+ ·97	104	26·96	Ribston Hall
...	5·41	5·12	—1·29	80	·63	5	22	60·96	67·45	+6·49	111	60·96	Arncliffe Vic.
...	2·36	1·98	— ·38	84	·34	15	23	27·02	25·46	—1·56	94	27·02	Hull
27	2·64	3·84	+1·20	145	1·64	27	21	27·99	30·19	+2·20	108	27·99	Newcastle
...	4·70	11·75	—2·95	80	1·60	2	21	132·68	130·66	—2·02	98	132·68	Seathwaite
...	4·43	2·75	—1·68	62	·38	25	20	42·81	43·49	+ ·68	102	42·81	Cardiff
...	5·22	4·85	— ·37	93	·80	27	23	47·88	50·41	+2·53	105	47·88	Haverfordwest
17	4·49	5·27	+ ·78	117	·66	11	23	45·41	47·64	+2·23	95	45·41	Gogerddan
...	2·95	2·49	— ·46	84	·36	15	23	30·98	31·57	+ ·59	102	30·98	Llandudno
...	4·68	4·17	— ·51	89	·85	5	15	43·43	45·42	+1·99	105	43·43	Cargen
...	3·18	3·06	— ·12	96	·61	28	20	33·04	34·68	+1·64	105	33·04	Riddell House
23	...	1·17	...	...	·53	12	12	...	31·24	...	..	...	Edinburgh
18	4·82	7·10	+2·28	147	1·46	11	20	44·85	44·04	— ·81	98	44·85	Colmonell
...	3·53	3·62	+ ·09	103	·80	15	16	35·80	40·21	+4·41	112	35·80	Glasgow
24	5·33	7·67	+1·34	121	1·80	15	22	57·90	67·94	+10·04	117	57·90	Tighnabruaich
20	6·48	6·31	— ·17	97	·74	1	24	57·53	54·48	—3·05	95	57·53	Quinish
...	2·73	1·70	—1·03	62	·50	12	16	28·95	26·65	—2·30	92	28·95	Dundee
...	3·15	2·29	— ·86	73	...	...	...	36·07	37·33	+1·26	103	36·07	Braemar
...	3·39	4·16	+ ·77	123	·93	28	17	33·01	35·63	+2·62	108	33·01	Aberdeen
...	2·53	1·91	— ·62	76	·32	26	15	29·37	31·89	+2·52	109	29·37	Cawdor
...	5·67	6·51	— ·16	98	1·17	2	18	56·00	60·03	+4·03	107	56·00	Invergarry
...	9·04	9·96	+ ·92	110	1·93	2	21	86·50	94·91	+8·41	110	86·50	Bendamph
...	3·39	3·22	— ·17	95	·52	15	19	31·60	41·41	+9·81	131	31·60	Dunrobin Castle
...	...	5·33	...	...	·97	4	25	...	39·80	...	...	...	Castletown
19	5·64	3·67	—2·97	55	·42	12	25	58·11	45·08	—13·03	78	58·11	Killarney
...	3·31	2·28	—2·03	53	·59	15	21	39·30	33·21	—6·09	85	39·30	Waterford
..	3·37	3·29	— ·08	98	·84	14	20	33·47	36·50	+3·03	109	33·47	Hurdlestown
...	4·46	2·28	—1·18	66	·96	15	19	34·44	27·75	—6·69	81	34·44	Carlow
...	2·39	1·81	— ·58	76	·37	15	18	27·75	22·81	—4·94	82	27·75	Dublin
15	3·63	..	...	...	...	...	...	37·04	...	...	...	37·04	Ballinasloe
...	5·99	5·96	—3·03	66	·86	29	18	80·23	71·10	—9·13	89	80·23	Kylemore House
...	5·81	5·69	— ·12	98	·65	25	28	50·50	51·11	+ ·61	101	50·50	Enniscoe
...	3·64	3·64	·00	100	·82	15	21	38·61	34·23	—4·38	89	38·61	Seaforde
17	6·31	6·88	+2·57	160	·74	15	26	41·20	45·35	+4·15	110	41·20	Londonderry
...	3·77	3·40	— ·37	90	·57	15	22	37·85	42·40	+4·55	112	37·85	Omagh
16													

SUPPLEMENTARY RAINFALL, DECEMBER, 1906.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	2·86	XI.	Rhayader, Tyrmynydd	...
,,	Ramsgate, West Cliff Villas	2·08	,,	Lake Vyrnwy	4·82
,,	Hailsham	2·56	,,	Llangyhanfal, Plâs Draw	3·83
,,	Crowborough, Uckfield Lodge	2·57	,,	Criccieth, Talarvor	4·89
,,	Osborne, Newbarn Cottage.	1·94	,,	Llanberis, Pen-y-pass	10·55
,,	Emsworth, Redlands	2·00	,,	Lligwy	3·93
,,	Alton, Ashdell	2·60	,,	Douglas, Woodville	5·29
,,	Newbury, Welford Park	2·59	XII.	Stoneykirk, Ardwell House	4·95
III.	Harrow Weald, Hill House.	2·26	,,	Dalry, The Old Garroch	7·72
,,	Oxford, Magdalen College..	1·67	,,	Langholm, Drove Road	4·20
,,	Bloxham Grove	1·52	,,	Moniaive, Maxwelton House	3·80
,,	Pitsford, Sedgebrook	2·49	XIII.	N. Esk Reservoir [Penicuick]	4·60
,,	Huntingdon, Brampton	2·30	XIV.	Maybole, Knockdon Farm..	3·86
,,	Wisbech, Bank House	2·02	XV.	Campbeltown, Witchburn	5·24
IV.	Southend Water Works	1·82	,,	Inveraray, Newtown	8·70
,,	Colchester, Lexden	2·09	,,	Ballachulish House	10·38
,,	Newport, The Vicarage	2·89	,,	Islay, Eallabus	6·30
,,	Rendlesham	2·69	XVI.	Dollar Academy	2·37
,,	Swaffham	2·21	,,	Loch Leven Sluice	1·67
,,	Blakeney	1·98	,,	Balquhidder, Stronvar	4·91
V.	Bishops Cannings	2·29	,,	Perth, Pitcullen House	1·47
,,	Ashburton, Druid House	3·48	,,	Coupar Angus Station	1·62
,,	Okehampton, Oaklands	4·44	,,	Blair Atholl	2·54
,,	Hartland Abbey	3·23	,,	Montrose, Sunnyside Asylum	2·04
,,	Lynmouth, Rock House	2·83	XVII.	Alford, Lynturk Manse	3·38
,,	Probus, Lamellyn	4·39	,,	Keith Station	1·85
,,	Wellington, The Avenue	1·70	XVIII.	N. Uist, Lochmaddy	4·38
,,	North Cadbury Rectory	1·96	,,	Alvey Manse	2·65
VI.	Clifton, Pembroke Road	1·53	,,	Loch Ness, Drumnadrochit.	3·10
,,	Moreton-in-Marsh, Longboro'	2·42	,,	Glencarron Lodge	13·72
,,	Ross, The Graig	1·31	,,	Fearn, Lower Pitkerrie	1·46
,,	Shifnal, Hatton Grange	2·74	XIX.	Invershin	3·39
,,	Cheadle, The Heath House.	3·61	,,	Altnaharra	5·88
,,	Coventry, Kingswood	2·25	,,	Bettyhill	3·72
VII.	Market Overton	2·74	,,	Watten Station	2·81
,,	Market Rasen	2·47	XX.	Dunmanway, The Rectory..	3·19
,,	Bawtry, Hesley Hall	2·17	,,	Cork	1·75
VIII.	Neston, Hinderton	3·01	,,	Darrynane Abbey	5·02
,,	Southport, Hesketh Park	3·03	,,	Glenam [Clonmel]	3·12
,,	Chatburn, Middlewood	...	,,	Ballingarry, Gurteen	2·38
,,	Cartmel, Flookburgh	4·70	,,	Miltown Malbay	4·88
IX.	Langsett Moor, Up. Midhope	3·88	XXI.	Gorey, Courtown House	2·33
,,	Scarborough, Scalby	3·21	,,	Moynalty, Westland	3·03
,,	Ingleby Greenhow	2·90	,,	Athlone, Twyford	2·63
,,	Mickleton	2·88	,,	Mullingar, Belvedere	2·92
X.	Bardon Mill, Beltingham	2·79	XXII.	Woodlawn	4·81
,,	Ewesley, Fallowlees	1·63	,,	Westport, Murrisk Abbey..	5·23
,,	Ilderton, Lilburn Cottage..	2·04	,,	Collooney, Markree Obsy..	5·25
,,	Keswick, York Bank	4·03	XXIII.	Enniskillen, Portora	3·85
XI.	Llanfrechfa Grange	1·92	,,	Warrenpoint, Summer Hill.	1·32
,,	Treherbert, Tyn-y-waun	5·09	,,	Banbridge, Milltown	2·78
,,	Carmarthen, The Friary	4·37	,,	Belfast, Springfield	4·61
,,	Castle Malgwyn [Llechryd].	4·10	,,	Bushmills, Dundarave	4·95
,,	Plynlimon	12·85	,,	Stewartstown, The Square..	3·59
,,	Tall-y-llyn	3·00	,,	Killybegs	9·41
,,	New Radnor, Ednol	3·54	,,	Horn Head	5·11

METEOROLOGICAL NOTES ON DECEMBER, 1906.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—Nearly normal temp. prevailed till the last ten days, when a period of severe frost brought the mean temp. down to 37°·8 or, 1°·4 below the average. There were a number of brilliant days in the first half, but the latter part was cheerless and damp. Four and a half inches of S fell during the night of 25th, and the four following days were all more or less snowy. Duration of sunshine 37·2,* and of R 51·6, hours.

CROWBOROUGH.—Cold, with frequent squalls and much frost, especially in the last 12 days. Blizzard with 5 inches of S on Christmas night. R ·89 in. below the average of 35 years. Mean temp. 35°·7.

TORQUAY.—Duration of sunshine 63·0* hours, or 9·9 hours above the average; 8 sunless days. Mean temp. 42°·9, or 0°·7 below the average.

CLIFTON.—The first and second weeks were showery, the third rainless, but damp and foggy, and the last frosty with S, although there was never more than an inch on the ground. R less than half the average.

ROSS.—Quite warm with much fine weather till 20th; the next three days cold, dry and "easterly," then about two and a half inches of S. The next four days were wintry but without much S; gentle thaw on 31st.

SOUTHPORT.—Extremely sunny yet exceptionally stormy. Duration of sunshine 46·6 hours,* or 14·4 above the average. Mean daily wind movement 50 miles above the average. R ·05 in. above the average; duration 72·9 hours. Mean temp. 38°·7, or 0°·9 below the average. The total depth of S was 9·3 in.

BOLTON.—A very wet month, with heavy S during the last week, when a fall of 8 inches on 25th, followed by lighter falls on 26th, 28th, 29th and 30th, produced a depth of 18 to 20 inches of undrifted S, the heaviest fall yet recorded for Bolton. Mean temp. 37°·4, or 1°·5 below the average. Duration of sunshine 24·5* hours, or 11·2 above the average.

HAVERFORDWEST.—Mild and stormy, with moderate R to 25th. S storm with gale on 26th, and S on 27th, 28th, and 29th; total depth 10 inches. In a severe gale on 5th a velocity of 82 miles per hour was recorded at Goodwick breakwater. Duration of sunshine 39·8* hours.

DOUGLAS.—An excessively stormy month, mild from 16th to 21st, but otherwise generally cold, with bitter polar winds. Between one and two inches of S fell between 25th and 30th.

DUMFRIES.—Five inches of S on the night of 25th, followed by E. and N.E. gale, which caused drifts 8 to 10 feet deep, blocking roads, &c.

LYNTURK.—The feature of the month was the S storm from 26th to 28th. The drifting and blocking were unequalled since 1880.

DRUMNADROCHIT.—R 1·32 in. below, and rain days 1 above, the average of 20 years. The S storm which began on Christmas day was the most severe for many years.

WATTEN.—The first half was wet, with storms of wind and fine intervals, followed by a week of fine fresh and open weather. Great gales in the closing week, with heavy S and severe frost.

CORK.—R 2·70 in. below the average, and mean temp. 3°·2 below the average.

MILTOWN MALBAY.—Bitterly cold and rainy, with little sunshine. The month ended in a furious blizzard, which lasted four days, accompanied by intense frost, gales and squalls.

DUBLIN.—The mean temp. was about the average, but varied from 46°·9 in the first week to 39°·4 in the second, 47°·9 in the third, and 34°·7 in the fourth. A period of S and frost set in on the morning of 26th, lasting till 30th.

OMAGH.—Till 19th the month was raw, damp and gloomy. Then a fine spell, followed again on 25th by heavy S and settled frost, which only disappeared with the advent of the New Year.

* Campbell-Stokes.

Climatological Table for the British Empire, July, 1906.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	83·7	18	45·2	1	76·0	54·6	57·9	75	129·2	40·5	·61	7	...
Malta	94·1	13	66·2	19	87·5	70·8	69·6	78	...	61·8	·00	0	1·2
Lagos	84·5	18	70·0	16	81·3	73·6	72·7	87	131·0	68·0	15·90	23	8·7
Cape Town	69·0	2	35·0	17	58·8	44·2	45·9	80	...	...	1·82	13	4·6
Durban, Natal	81·0	5	46·1	15	74·8	52·9	...	...	131·2	...	·28	6	2·0
Johannesburg	67·2	30	23·1	16	59·3	40·2	33·4	59	127·2	...	·00	0	0·9
Mauritius	76·8	15	55·1	28	74·4	62·5	60·1	77	136·9	47·7	5·53	26	6·8
Calcutta	93·1	13	74·5	2	89·7	79·5	78·2	85	159·0	73·1	12·69	17	8·3
Bombay	87·3	1	75·0	21	84·3	77·8	76·9	87	132·0	73·8	18·10	28	9·4
Madras	103·2	2	73·0	28	97·1	79·1	74·1	72	143·7	72·7	4·45	15	6·2
Kodaikanal	69·2	4	50·6	21	63·6	53·3	52·0	83	143·6	44·3	6·89	21	7·7
Colombo, Ceylon	89·2	21	74·4	19	85·8	77·6	73·9	81	149·0	73·0	4·42	14	7·3
Hongkong	91·2	21	75·9	23	87·7	79·5	76·2	80	143·7	...	6·95	17	7·3
Melbourne	64·9	12	33·0	26	56·4	44·2	41·4	75	118·2	27·3	1·34	10	6·7
Adelaide	74·0	11	39·3	24	60·0	46·2	45·3	77	120·8	34·1	2·87	18	6·4
Coolgardie	78·9	8	30·1	19	59·8	42·0	38·9	69	138·6	26·0	·88	10	5·0
Sydney	72·0	12	37·7	19	61·9	46·0	39·7	70	109·7	29·1	·20	12	2·9
Wellington	59·5	23	33·5	29	53·7	44·0	41·6	73	109·0	24·0	2·66	19	5·7
Auckland	63·0	19	41·0	28*a*	56·9	46·5	45·5	79	115·0	37·0	6·80	26	7·0
Jamaica, Negril Point	89·1	2, 15	69·1	25	87·2	73·2	73·9	79	...	...	4·83	15	...
Trinidad	95·0	27	69·0	sev.	86·3	71·1	73·8	84	162·0	67·0	11·42	16	...
Grenada	86·4	20	71·0	13*b*	83·7	74·0	72·4	82	146·0	...	11·18	28	4·3
Toronto	92·1	22	50·8	6	79·9	60·3	61·1	75	112·0	43·0	3·41	9	4·9
Winnipeg	89·0	11	46·5	31	77·5	56·3	...	...	...	...	3·37	10	4·8
Victoria, B.C.	88·5	3	50·1	7	76·7	54·3	...	69	...	...	·16	1	2·6
Dawson	80·0	12	39·0	3	72·2	47·8	...	...	...	...	1·20	14	6·3
St. John's, N.B.	82·0	15	50·7	6	69·0	55·1	...	...	...	...	2·59	16	6·6

a and 31. *b* and 14, 24.

MALTA.—Mean temp. of air 77°·4, or 0°·4 below the average. Mean hourly velocity of wind 7·9 miles, or 0·5 above average. Mean temp. of sea 77°·6.

Mauritius.—Mean temp. of air 0°·3, dew point 0°·7, relative humidity 1·2 per cent., and R 3·23 in. above, averages. Mean hourly velocity of wind 11·9 miles.

MADRAS.—TS on 4 days, distant T on 6 days, and L on 4 other days.

KODAIKANAL.—A cloudy and showery month. Bright sunshine 164 hours.

COLOMBO.—Mean temp. of air 81°·3, or 0°·6 above, of dew point 0°·6 above, and R ·09 in. below, averages. Mean hourly velocity of wind 8·6 miles.

HONGKONG.—Mean temp. of air 82°·9. Bright sunshine 215·2 hours. R 6·4 in. below, averages. Mean hourly velocity of wind 11·8 miles.

Adelaide.—Mean temp. of air 53°·1, or 1°·6 above, and R ·31 in. above average. The shade max., 74°·0, on the 11th is the highest daily reading for July in 50 years.

Sydney.—Mean temp. of air 1°·7 above, and R 4·36 in. below, averages.

Wellington.—Mean temp. of air 1°·3 above, and R 3·43 in. below, averages.

TRINIDAD.—R 2·38 in. above 43 years average.